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THE REMOVAL OF "LA PARISIENNE," MOREAU-VAUTHIER'S FAMOUS STATUE.

THE LAST OF MORÉAU-VAUTHIER'S "PARISIENNE."

It is doubtful whether any piece of sculpture at the Exposition attracted so much attention, or was so generally discussed, as the symbolic statue representing the city of Paris. Moreau-Vauthier cast all artistic traditions to the winds when he represented the city of Paris, not by a draped allegorical figure, but by a modern Parisienne, dressed *à la mode*, and carrying herself with that air of sprightliness which is considered *chic*.

As the buildings of the Exposition were destroyed, one by one, the turn of "La Parisienne" finally came. From her perch, 150 feet in the air above the Place de la Concorde, she was slowly lowered with a derrick and tackle, and was safely deposited on the ground, after a full day's work.

The fate of the statue, according to L'Illustration, is still a matter of conjecture. Rumor has it that the superintendent of the work of demolition intended to send "La Parisienne" to his native town, situated in some part of Auvergne, but that a Hungarian magnate had purchased her with the intention of setting her up on his estate.

RESTORING ST. MARK'S, VENICE.

I think no better proof of the progress Italy has made during the last twenty years in true artistic taste and sentiment is needed than the fact that, whereas not so very long ago Ruskin appealed to England for a fund to enable copies to be made of the invaluable mosaics and carvings in St. Mark's Church, Venice, before they fell into complete ruin, it is now the Italian government itself that has taken in hand their saving and their restoration, and England has now only to look on with approval, says the correspondent of The London Globe. Ruskin, in his later days, was apt to imagine that he had preached in the desert, but were he alive now he would see that here in Venice his teaching has not been thrown away. The Ministry of Public Works has realized that to restore means to restore, and that to destroy an ancient thing and to replace it by a modern one is not to restore it. Before the new order of things, when anything was considered unsightly it was pulled down, often thrown away, and common work of the period set up in its stead, with the result that the thing "restored" was not ancient, nor valuable, nor beautiful, nor durable—not even a good copy, since the workers then had neither artistic eye nor taste. Now, however, this is all changed, and the government, by the appointment of the right men for the work, has insured that St. Mark's should be preserved and restored as nearly as perfectly as is humanly possible.

Any one who sees St. Mark's after an absence of a few months will at once be struck by the manner in which the old "Opus Alexandrinum" mosaic work, with which the church was originally paved, and of which so little remained, has spread itself out over the flooring. All round the great white slabs under the central dome, in the two transepts, and down the right aisle, all is rich in subdued color. The disfigurements of the last two centuries have disappeared. The hundreds of bits of common, rubbishy, Verona, Brescia and Carrara, with which the original valuable tesseræ had been replaced, have been emptied into the yard behind the church, and the lovely tesseræ of porphyry and verd antique, jasper and malachite, once more occupy their rightful place—priceless material lately excavated from the ruins at Aquileia, Concordia and Cyrado. It is not so much, however, the beauty of the material that is so striking as the masterly manner in which the work is done. It is really hard to believe that the inequalities of the pavement and the worn appearance of the tesseræ is not the work of time and of the treadings of many feet, instead of being the result of ingenious and anxious study. I learn that the architect, before undoing any part of the pavement, takes a plaster cast of it, numbering the position of each of the ancient tesseræ, and from this he forms his restoration, having each separate bit hand cut and ground to the exact size and shape of the one it is to replace. Where a pattern is half old and half new it is impossible to tell where the one begins and the other ends. It is really what some one has called "The Philosophy of Restoration." If any one wishes to see in what a disgraceful condition the whole pavement was in up to very lately he has only to look at any portion not yet restored, such as the left aisle, which was cobbled by a local factory in the ignoble days of thirty years ago, or in front of the altar of the Virgin, where one sees a few bits of antique marbles lost in a wide stretch of common Verona and Carrara tesseræ, a crooked square stone filling one blank, and great blotches of plaster the others, making the whole look for all the world like a beggar's coat. Forming a striking contrast to this particular blot upon the harmony of the church is one of the finest bits of restoration that have been done. It is a huge rose of geometrical pattern formed of the richest porphyries and verd antique, radiating from a center; and this center, an offering, I believe, of the architect himself, is a thick slice of an exquisite amethyst, over three inches in diameter. If the unrestored part I spoke of above is like a beggar's coat, this one can only be likened to a king's robe of state.

Other improvements are giving back its richness to the church. A splendid slab of verd antique, found in the rubbish heaps with which the various recesses of the church were found to be filled, has been sliced in two, and now one half forms the front of the altar of St. Peter, and the other the center of a panel in the Zeus Chapel. The passages leading to the sacristy and to other chambers have all been lined either with marble or with gold mosaic. The great cupolas have now been given back to their original splendor, the decayed and blackened plaster, in which their mosaics were embedded, and which had dimmed their luster, has been scraped away, and each tessera secured by good cement, so that now the old colors shine out once more to full advantage. Much other work has been done, but I have said enough, I think, to show that government and architect are doing credit to themselves and to St. Mark's Church.

CONVERSION OF PHOSPHORUS INTO ARSENIC.

From the German of Prof. F. Fittica, of the University of Marburg, in the Leopoldina.

The opinion has been expressed by Flückiger that the modification called black phosphorus consists only of arsenic, and he explains its existence in ordinary phosphorus by its apparent production by means of the action of ammonia on the phosphorus, on the supposition that ordinary phosphorus contains a mixture of arsenic, the phosphorus dissolving in the ammonia, with production of Ph_2, while the arsenic remains intact.

My researches, however, have led me to conclude that in the reaction of phosphorus, or arsenic, in presence of air, a veritable conversion of phosphorus into arsenic takes place, and that the latter seems to be an oxy-nitrogenized compound of phosphorus.

First, I will confirm the observation that in treating ordinary phosphorus with a concentrated solution (20 per cent) of ammonia by the water bath at about 60 deg. C. (the phosphorus being then liquid), shaking frequently to facilitate access of the air, the latter is transformed into the black modification; in reality, is converted into arsenic.

The operation succeeds best in a flat-bottomed bottle, of a capacity larger than would be necessary for the quantity of substance employed, in order that a larger surface may be presented to the air. The bottle, fitted with a long glass tube, designed to prevent as much as possible the evaporation of the ammonia, is removed from the water bath from time to time and shaken for a moment, in order to bring the contents in contact with the air. The quantities of arsenic thus obtained are, however, very small. I have, therefore, employed more energetic oxidants than the oxygen of the air, taking, in the first place, hydrogen peroxide.

On treating the phosphorus with concentrated ammonia, adding a solution, recently prepared, of hydrogen peroxide, and leaving the mixture at repose at the ordinary temperature, for a certain time, I obtain larger quantities of arsenic. Even in this case the quantities have been quite restricted, insufficient to confirm the surmise I had formed that there was not a contamination of the phosphorus by the arsenic, but a real production of the latter.

For the purpose of securing a sure foundation for my conclusions, I examined red phosphorus and white phosphorus, with reference to their proportion of arsenic. I found that, with equal quantities of phosphorus, I obtained variable quantities of arsenic, whether using white or red phosphorus, or with different oxidants.

Generally the red phosphorus yielded a larger proportion of arsenic by the usual oxidation with nitric acid, and especially by employing barium binoxide with nitric or chlorhydric acid, or potassium chlorate and chlorhydric acid. The same sample of white phosphorus, which, with dilute nitric acid, yielded scarcely appreciable traces of arsenic, yielded with the same acid concentrated very sensible quantities, and larger still with barium peroxide and nitric acid; 0.4294 grain of phosphorus yielded 0.0142 of arsenic sulphide, corresponding to 2.5 per cent of arsenic; 0.501 of phosphorus yielded 0.02012 of arsenic sulphide, corresponding to 2.5 per cent of arsenic. From amorphous phosphorus, more than 2.6 per cent of arsenic can be thus obtained, 1.3981 grains yielding 0.049 grain of As_2S_3, corresponding to 2.13 per cent of arsenic; 0.2266 yielding 0.010 of As_2S_3, corresponding to 2.64 of arsenic.

The yield by the oxidation of barium peroxide and chlorhydric acid is slight, and I have not succeeded in obtaining suitable results by employing varying quantities of the same substances. But when 1.02 grains of amorphous phosphorus was oxidized by mixing carefully with barium peroxide and heating the mixture with dilute sulphuric acid, or adding to the mixture water and concentrated sulphuric acid (for 1 grain of phosphorus 13.63 grains of BaO_2 and 8 grains of H_2SO_4), the slight traces of precipitate obtained by the hydrogen sulphide in the product of complete oxidation, from which the barium sulphate was separated by filtration, were found to be pure sulphur completely soluble in carbon sulphide. The precipitate extracted by ammonia yielded a trace of a substance, which was also completely soluble in CS_2 and burned on a platinum plate with a blue flame.

It was, therefore, manifest that the production of arsenic proceeding from the phosphorus was due to nitric oxidants and the employment of ammonia. Then I endeavored to effect a synthesis of the arsenic by employing nitric acid and ammonia at the same time, and also by employing nitrites. If ordinary phosphorus is heated by the water bath, in a tube connected with a condenser, with ammonium nitrate, no reaction takes place under 60 deg., but the action then becomes so violent that explosions may occur, even in presence of ammonium carbonate, on account of the well-known fact that phosphorus burns in the vapor of ammonium nitrate exactly as in a current of oxygen.

When phosphorus is heated with ammonium nitrate and potassium nitrite, in presence of ammonium carbonate, an excessively violent action occurs at a temperature of about 100 deg.

Amorphous phosphorus appears more suitable for the synthesis; and, after many fruitless experiments, I succeeded by the following process, which, so far as I can now state, affords a yield of 8 to 10 per cent of the crude product:

Two grains of amorphous phosphorus, free from arsenic, according to a previous test, are carefully mixed with 12.9 grains of ammonium nitrate finely pulverized, placed in a tube, which should not be too contracted, and heated by the sand bath, so as to attain the temperature of 180 deg. A reaction is produced, which should be moderated, if necessary, by removing the flame. Then the temperature is gradually raised to 200 deg. When the reaction is terminated, the mass is left to cool, then dissolved in water, and the solution filtered and precipitated by hydrogen sulphide. The precipitate is dissolved in ammonium carbonate, and the arsenic sulphide, precipitated from the solution, may be identified by the manner in which it behaves with ammonia and chlorhydric acid, by its oxidation in arsenic acid, and its precipitation with a magnesian solution, as well as by a test of the magnesian precipitate in the Marsh apparatus.

Taking account of the decomposition of the ammonium nitrate by the heat and the proportions given above for the phosphorus and the ammonium nitrate, the formation of arsenic by means of phosphorus takes place according to the following equation:

$$2P + 5AzH_4AzO_3 = (PAz_2O)_2O_2 + 10H_2O + 3Az_2.$$

Besides the principal reaction, there is at least one secondary reaction, as may be seen by the production of white fumes having a neutral reaction. These fumes may be collected in water, which dissolves them. They contain phosphorus, and yield sulphur free from hydrogen sulphide. To correspond to the equation above, the arsenic would be an oxy-nitrogenized compound of phosphorus, of which the formula would be PAz_2O.

DISPOSAL OF HOUSE REFUSE IN BRADFORD.

The population of Bradford is estimated at 292,300; the acreage is 22,843; the average number of people per acre 12.8, and the ratable value is £1,396,067 7s. 6d. The total quantity of refuse collected is 125,000 loads per annum from 32,164 ashpits, to which 180,000 visits are paid, giving an average of 3.87 loads per ashpit and 5.6 per annum to each.

At the present time about 90,000 loads are destroyed annually at the destructors, the remainder being either tipped in the out-districts or sold to farmers. The total number of destructor cells is 53, being 29 at work, 6 rebuilding, and 18 to be erected. These when complete will have a total destroying capacity of 145,000 loads per annum.

The destructors are of the Horsfall pattern, each one consisting of two blocks of six cells of the back-to-back type, with two 11 feet by 8 feet multitubular boilers, the chimney being placed between the two blocks. Each block of cells has a flue leading to one of the boilers and an alternative flue leading to the chimney. Some improvements in details of construction have been introduced, and air flues have been made under the tipping-floor, which keep it cool by the induced current of air passed through them by means of a steam-jet. An overhead railway is also provided for the removal of the clinker. A working test of the destructor gave the following results:

TEST OF THE HORSFALL DESTRUCTOR, JUNE 24 TO JULY 7, 1900.

Number of cells: 12.
Type: Back to back.
Duration of test: 278 hours.
Nature of fuel: Midden, market and dry refuse.
Number of men employed: 12 furnace men, 6 chargers.
Wages: Furnace men, 28s.; chargers, 25s.
Total quantity of refuse burned: 2,896,320 pounds = 1,293 tons.
Total quantity of refuse burned per cell per 24 hours: 20,837 pounds = 9.3 tons.
Total cubic feet of refuse burned per cell 24 hours: 543.
Total quantity of refuse burned per square foot of grate per hour: 34 pounds.
Total quantity of refuse burned per cell per hour: 868 pounds.
Cost of labor per ton destroyed: 9d.
Total weight of water evaporated: 2,153,000 pounds.
Total weight of water evaporated per hour: 7,744 pounds.
Total weight of water evaporated per cell per hour: 645 pounds.
Water evaporated per pound of refuse burned: 0.743 pound.
Water evaporated per pound of refuse burned from and at 212 degrees F.: 0.882 pound.
Weight of clinker produced: 817,516 pounds = 364.96 tons.
Weight of fine ash produced: 26,936 pounds = 12.02 tons.
Weight of fine dust produced: 5,992 pounds = 2.67 tons.
Total weight of residuals: 850,444 pounds = 379.65 tons.
Percentage of residuals: 29.36 per cent.
Steam pressure maintained (by recorder): 60 pounds.
Temperature of feed-water: 60 degrees F.
Temperature of gases in main flue: 1,800 degrees F.
Temperature of gases at bottom of chimney: 1,000 degrees F.
Average air pressure (water gage): ⅞ inch.
Total I.H.P. per hour at 20 pounds: 387.2.
Total I.H.P. per cell continuously: 32.2.
I.H.P. hours per ton burned: 83.2.

The main importance of the installation lies in the arrangements for turning the residuals to profitable account. The steam produced is partly utilized in driving eight mortar mills, which turn out mortar at the rate of 12,000 tons per annum, and for working hydraulic machines, which are used in the production of artificial stone slabs for paving. Concrete bricks, consisting of a 10 per cent mixture of hydraulic lime and clinker, are also manufactured at a cost of 14s. per 1,000. A small machine turning out 8,000 bricks per day requires over 20 tons of clinker for that purpose; and the manufacture of ornamental tiles from the same material is being commenced. Sifted clinker of various grades is also disposed of by sale, and old tins, scrap iron, etc., go to chemical works, scrap merchants, and others. In addition to the machinery above mentioned there is a complete plant for the manufacture of artificial guano from the fish refuse, of which from 600 to 700 tons are dealt with annually and reduced to 25 per cent of its original bulk, making a profitable product which is sold at £3 per ton.

The new destructor being erected will reduce the labor for tipping and charging, and is expected to

reduce the labor cost of destroying the refuse to 5½d. per ton.

The following statement shows how the power generated during the fortnight's trial recorded above was utilized, and the returns from it:

	£	s.	d.
306 tons 13 cwts. 2 qrs. of mortar made and sold, value.....	82	8	6
442 tons of crushed clinker sold, value	14	14	8
245 sq. yds. of concrete flags manufactured, value	38	15	10
3 tons 3 cwts. 3 qrs. old tins sold, value	0	15	11
About 4 tons of fish guano manufactured, value	12	0	0
	£148	14	11

—J. McTaggart in Electric Review.

NAVAL GUN CIRCUITS.

THE advantages that are obtained by using electricity for firing guns in the navy are twofold. First and foremost is the increased safety; for with its electric circuit broken until the gun is run out, a gun can only be fired in a safe position, and the fuse, or tube as it is called, containing no fulminate of mercury, allows of rough handling of the cartridge, which under the circumstances that attend a rapid and continual fire is inevitable, or practically so. The second advantage is in the position of the captain of the gun, who can keep his eye along the sights and his finger on the trigger the whole time the gun is being loaded, so that he is ready to lose no time directly the gun is out again.

In percussion firing, which is always an alternative in case of the electric circuit failing, the lanyard that releases the striker is not in the hands of the captain of the gun himself; it is pulled by a subordinate on the word "Fire!" When the movement of the ship is considered, together with the motion of the target, the fraction of time that elapses between the word of command and its execution makes no small difference to the practice.

A reference to the accompanying diagram will show how the circuit is arranged in the 6-inch quick-firing gun. The sights are fixed on the mounting, and not on the gun itself, which, by its recoil, would otherwise force the captain of the gun to take a fresh alinement each round. There are two sets of sights, one on either side, two batteries, and naturally two distinct firing keys, which are in the form of a pistol, the trigger making contact on being pressed.

The circuit in each case may be traced from the negative pole of the battery through the firing key to a rubbing contact at the outer extremity of the recoil slide; a contact piece on the gun itself takes against this when the gun is fully run out, and only then is the circuit complete to the striker. The striker, so called from the fact that it is made to do duty as such when percussion fire is resorted to, consists of a steel tube filled with gutta-percha insulation, through the center of which runs the circuit, ending in a brass nipple, which takes against the contact piece on the fuse itself when the breech is closed. A mechanical device on the breech prevents this nipple from making contact until the breech-piece is properly home, so that it would be impossible to fire the gun with the breech only partially in position. The nipple makes contact with a small disk that is well insulated from the brass cartridge into which the fuse is screwed, and the circuit proceeds from this disk to a thin platinum bridge embedded in priming composition and thence to earth, which is represented by the brass cartridge case and the gun. The positive pole of the battery being brought to the gun mounting picks up the return through the gun. Now, it will be seen that no dangerous premature explosion can take place, even through the greatest carelessness. In the excitement attendant on gun practice, details of the drill-book are sometimes overlooked, and however well trained a man may be, he is not infallible, as the occasional accidents that have occurred in times past go to show.

It may be argued that mechanical means can be provided to prevent the striker from being released, in the case of percussion firing, until the gun is in a safe condition, and that electric circuits have the disadvantage of giving out on small provocation; this is true, but hitherto it has been found very hard to devise a percussion lock that will withstand sufficient wear and tear to be absolutely reliable. With electricity, if there is a failure it is on the safe side, for it simply results in the gun not going off at all.

The turret or barbette circuits in battleships of the later types, such, for instance, as the "Majestic" class, serve as a very good illustration of the precautionary measures that are provided to insure against accidental firing of the gun when in an unsafe position, or before the breech is properly closed.

The safety arrangements may be divided into four, namely, the firing-key, the ring switch, the run-out contact and the breech-locking bolt. If we trace the circuit in the accompanying diagram, we shall see that it is in duplicate, one battery being placed on each side of the turret, and the connections between each battery and its individual gun exactly similar. Thus, in either case we start from the negative pole of the battery and come first to the firing-key. This key or pistol is represented in the figure at *K*, and it is placed in the sighting hood from which the captain of the gun lays his sights.

The circuit is seen to continue from *K* to the rear switch, *S*.

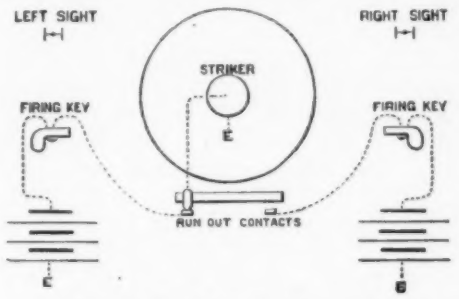
The rear switch has two duties to fulfill, the most important being the safety it provides for the man whose duty it is to place the fuse or tube in the gun. If this switch is at "off" it is obvious that the tube cannot be fired while the man is immediately in rear of it, and thus cause, by the recoil of the gun, the death of the man attending the breech mechanism; it is under his control, and he only puts it to "on" when he is in a safe position immediately before the gun is reported ready.

From this switch the circuit proceeds to *R*, the run-out contact. This contact is made by the gun itself, automatically, upon reaching the limit of its run out position, so that in case of the gun not being properly ran out to its full extent it will be impossible to fire it. Were this safety arrangement not there, the gun might be fired when only half out. Its recoil would then be only partially absorbed by the hydraulic cylinders, and disastrous consequences might ensue; in any case there would be a heavy strain brought upon the mounting. From this contact we now come to the fourth and last safety arrangement, which is the breech-locking bolt, *B*.

The breech-locking bolt provides against the gun being fired when the breech is not properly closed, and in order to explain its action it will be necessary first to examine the means by which the breech is screwed home.

After the gun has been loaded, a cradle, in which rests the breech piece, is moved over by a hydraulic ram until it is opposite the chamber. A second ram then pushes it from the rear into the gun.

So far the breech piece is not locked in any way, and it is not until the gun begins to run out that a projection on the breech piece, taking in an inclined slot on the carriage, forces it to revolve within the chamber and the screw threads to take. Until the breech has



6-INCH QUICK-FIRE GUN CIRCUITS.

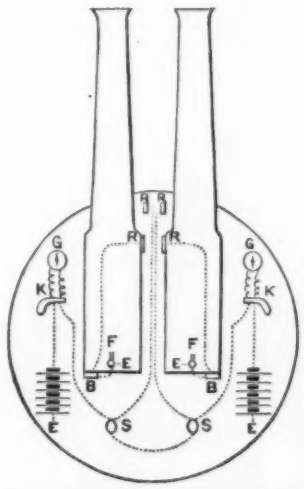
performed nearly a quarter of a turn, it is not properly home and the gun is not safe. To provide against the possibility of the gun being fired without the breech being properly and securely closed, this fourth safety device is designed. It consists of a locking bolt which works on an inclined plane as the gun runs out, and the circuit is passed through this bolt, insulated from it, of course, so that when the bolt locks the breech piece to the gun the fact of its coming into position completes the circuit.

The circuit proceeds then from the locking bolt direct through the contact piece on the gun tube, thence through the fine fusible bridge embedded in priming composition, and thence to the brass body of the gun tube, where it picks up an earth return in the metal of the gun itself; the positive pole of the battery being led to earth.

With the circuit as at present described, it will be seen how either battery may be made to fire its own particular gun; but in practice it is often necessary to fire both guns simultaneously.

The captain of the barbette or turret usually takes up his position in one of the sighting hoods, and lays both guns from that position—it would cause waste of valuable time if he had to change his position for each gun—and so the two circuits are connected together by a wire between the two switches, *S*. It will now be seen that either battery may be made to fire the guns singly, or both simultaneously, according to the connection made by the switch at *S*, so that if either battery fails the other may be substituted.

A vertical galvanometer, offering a resistance of 1,000



TURRET CIRCUITS, 12-INCH BREECH-LOADING GUNS.

ohms, can be switched into the circuit in place of the firing key immediately before the gun is fired, and this will show if the circuit is complete. Its high resistance renders the current too small to fire the fuse, and thus the circuit may be tested when the gun is loaded.—The Electrical Review, London.

THE LAC INDUSTRY OF ASSAM.

LAC occurs in its natural state in various places in the forests of Assam, and is produced more or less in most districts of the province. Kamrup and the northern parts of the Khasi and the Garo Hills, bordering on Brahmaputra Valley, are at present the chief seats of the cultivation. The Assistant-Director of Agriculture in Assam, in a recent report, states that in Kamrup, lac cultivation is chiefly confined to the south bank of the Brahmaputra, the annual outturn of stick lac in two mauzas (Rani and Chhayani) being estimated at over 60 tons. A small quantity is produced by a few Kachari families in Mauza Jhargaon on the north bank. The bulk of the lac exported from the district is, however, obtained from Garos inhabiting the northern slopes of the Khasi Hills. The annual export of recent years has averaged 16,000 maunds, or something over 500 tons, but in some of the forests, owing to the ravages of the *kolaazar* epidemic and depopulation, the production is certainly falling off. In Manipur the production is not sufficient for local requirements, and considerable quantities are sent there from the Kubo Valley of Assam. With the exception of a small quantity of manufactured lac, the entire quantity of lac exported from Japan is in the crude form or stick lac. The principal lac-producing trees in Assam are the *Ficus cordifolia*, *Ficus altissima*, *Cajanus indicus*, and *Zizyphus jujuba*. Lac also grows on several other species of *Ficus*, of which *Ficus religiosa*, *Ficus bengalensis*, *Ficus elastica*, and *Ficus infectoria* are the principal. The two chief lac-yielding trees of Bengal—namely, the *Palas* and the *Kusum*—are little known in Assam. The method of cultivating lac in Assam is practically the same as in Bengal. There are usually two crops a year, one being collected in May and June, and the other in October and November. In Sylhet the first is called the Aus, or early crop, and the second the Aman, or late crop. The first crop is mainly used for seed purposes; the second is the chief crop, and supplies the bulk of the exportable article. A few days after the harvest, pieces of stick lac, containing living insects (rahilaha) are tied on to the branches of the trees on which the next crop is to be grown. The usual plan is to place the stick lac in small bamboo baskets, and tie these on to the twigs of the trees. In a few days the insects crawl out of the sticks and spread over the young branches, on which they at once begin to feed and secrete the resin. The secretion of lac is allowed to go on for about six months before it is gathered in. If sufficient lac has not been secreted, the insects are left undisturbed for another six months. After the harvest a fresh crop is immediately prepared. It is said that a *Kathali bat* tree (*Ficus altissima*) can grow lac for three or four years in succession, after which it requires rest. Some trees have been known to produce lac for ten or twelve years without rest. The lac insect does not thrive on *Ficus* trees, which are of vigorous growth, and contain an abundance of gum; but thrives best on trees of moderate vigor. The lac crop is liable to several kinds of pests, among which the most injurious are a species of ant and a tiny moth, both of which feed on and destroy the insect. The depredations of ants can be prevented, to a certain extent, by keeping the trunks of the trees clean, and by attracting the ants with jaggery and then destroying them with fire. Stormy weather at the time when the young insects are spreading over the tree may destroy them altogether. Shell and button lac are manufactured in small quantities in Sibsagar and Cachar. The process of manufacture is as follows: The crude lac is first crushed and sifted, to free it from woody matter. It is then subjected to a long course of alternate washing and drying until the resin is thoroughly free from coloring matter. The lac, called at this stage "seed-lac," is then put into a long cloth bag which is held and slowly turned over a charcoal fire. When the resin inside the bag has melted, it is squeezed out by twisting the bag, and is brushed off by drawing it over the smooth surface of a piece of plantain bark. In Sibsagar the lac is washed in alkaline water prepared from the ashes of the plantain tree at one stage of the long course of washing to which it is subjected. Occasionally the residue left in the process of dyeing with crude lac is melted and cast into cakes, which are sold along with stick lac, but they still retain some dyeing matter. Another preparation of lac used in Assam is what has been called "boiled lac." In the Assam Valley it is known as "Bhiri Laha." It is prepared by boiling stick lac for some hours until it becomes soft, and then pressing the softened mass into cakes. It, of course, retains the whole of the dye. The articles usually colored with lac dye are cotton cloths and thread of every kind of material, and the use of the dye in the Assam Valley is confined to the Kacharis, Mikirs, and the non-Hindu tribes. The Hindus have a natural aversion for dyes of animal origin. The art of manufacturing lac wares seems to be dying out in Assam. Sibsagar and Sylhet are the only two districts where the art is still practised. In Sibsagar the following colors are used. They are prepared by mixing shellac with the substances noted against them respectively: (1) Yellow with orpiment, (2) red with vermilion, (3) blue with indigo, and (4) black with lampblack or fine charcoal obtained by burning the dry shell of a bottle gourd. In Sylhet a larger assortment of colors is in use. These are: (1) Sky blue, obtained by mixing powdered indigo and sulphur with shellac; (2) red, by mixing lac with vermilion; (3) violet, with violet powder; (4) gray, with white lead; (5) brick red, with red resin; (6) orange, with vermilion and orpiment; (7) dark green with powder; (8) green, with indigo and orpiment; (9) black, with lampblack, and (10) yellow, with orpiment. The violet and green powders are imported, and are of mineral origin. Wooden toys are the only wares ordinarily ornamented with lac in Assam. Sylhet town was once noted for its lac toys. These are now made only to order for export to Dacca and Calcutta. The following articles are occasionally ornamented with lac in Assam proper: Stands for trays, legs of wooden seats, circular boxes, shuttles, lampholders, cylinders of native drums besides several other kinds of turned wooden wares. Lac is also used in Assam proper as a protecting varnish over designs painted on wooden surfaces, e. g., on trays, palanquins, and bedsteads. The art of etching on lac is not known in Assam. It may be mentioned that the so-called black lacquer of Manipur is not a lac preparation, but is the juice of a tree known as Khen in Manipur. It is imported into Manipur from the Kubo Valley, in Burma. The juice is extracted by making an incision in the tree. It is used in painting handles and cases of swords and knives, saddlery and leather work of all descriptions, gunstocks, etc. The Lushais are said to paint gun stocks, and often gun barrels, with this varnish. The *Khen* tree may be allied to the *Rhus vernicifera* of

Japan, which yields the celebrated lacquer varnish of that country. There is nothing novel in the method of applying lac to wood as practised in Assam. It is only turned wooden articles to which lac can be conveniently applied. The article to be so treated is placed on the lathe, and while it is revolving the part of it to which the ornamentation it to be applied is heated and colored by alternately pressing the end of a bamboo or rattan stick and a lac pencil of the desired color against it. The heat generated by friction with the former causes the lac subsequently applied to partially melt and set itself upon the surface of the revolving article. The coating of lac is then smoothed over, and polished by skillfully manipulating a leaf of *Kewa* or *Kaya Kathal* over the revolving surface. As already mentioned, Sylhet and Sibsagar are the only districts in Assam where lac wares are now made. As regards the miscellaneous uses of lac, a common domestic use is as a cement to fix the handles of long knives. Metal workers use it in joining separate parts of metal utensils, and in fixing wares to the lathe for turning. Goldsmiths use lac for filling up the inside of hollow ornaments. In South Sylhet lac is used for making bangles and other ornaments used by the lower classes of Mohammedan women.—Journal of the Society of Arts.

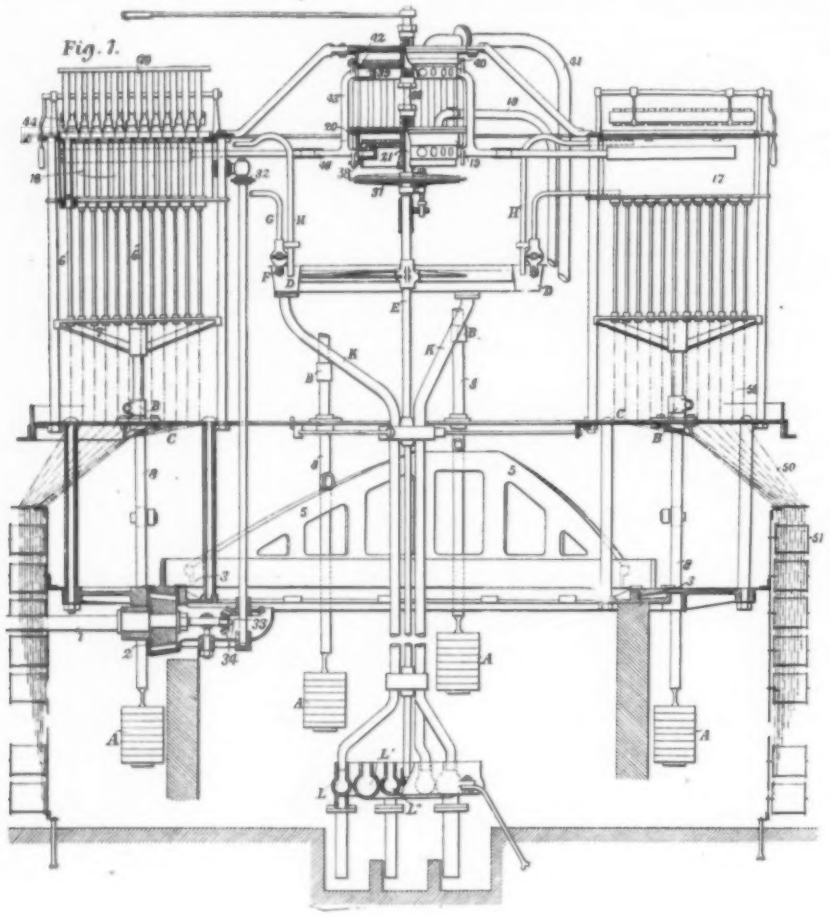


Fig. 1.

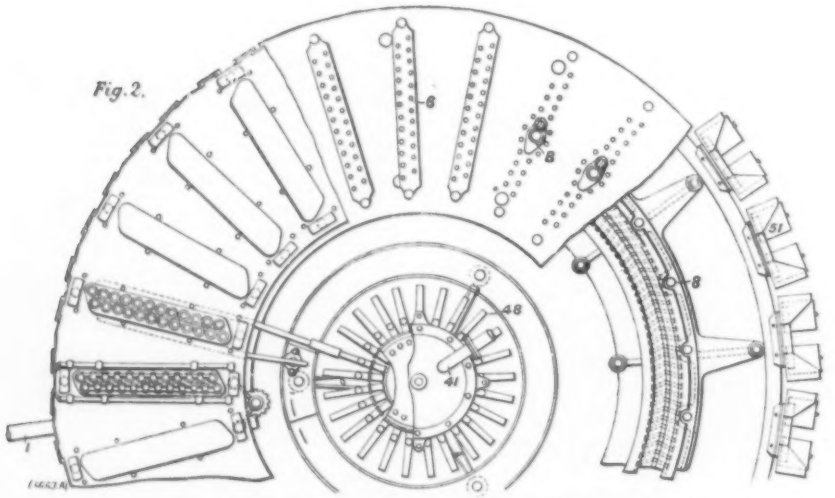


Fig. 2.

CONTINUOUS CANDLE-MAKING MACHINERY.

CANDLE AND SOAP MANUFACTURE AT THE PARIS EXHIBITION.

In the French Section of the recent Paris Exhibition the firm of Fournier, of Saint Denis, showed a continuous machine for molding candles, in which the molds are arranged on a circular plate, and the mechanism which drives out the candles when they are cooled down is fitted underneath. This is obtained by a rod carrying a plate on which the plungers are fitted. Fig. 1 is a vertical section through the center of the machine; to the left can be seen a molding set, the plungers of which are in their lowest position. If the left side of the figure be considered, it will be seen that shaft marked 1, driven by the engine, acts through a pinion, 2, on the rack, 3, placed around the drum, 4, which is thus given a continuous rotary motion. A sector, 5, fitted on the circular rack, forms a cam which gives the following action: The 20 plungers, 6, of one set, are carried by a plate, 7, fitted to a rod, 8, provided with a small friction roller that is raised at the right moment during the course of the process, by sliding on the revolving cam, 5. The lowering of the rod, 8, and of the plunger, 6, is obtained by the action of the counterweight, *A*. The lower limit of travel varies according to the length of candles to be made; the travel is regulated by the collar, *B*, which can be adjusted at the required height on rod, 8, and by butting against plate, *C*, the plungers are held in a suitable position, inside the molds. When the molding operation is complete, the plungers push the candles out of the molds; a horizontal surface on the cam keeps the plungers up, and the rotary action continuing, they descend to their former position in the molds, and a second operation is proceeded with. Round each group of molds, 16, are boxes, 17, which are successively filled with hot and cold water. Before filling, the molds have to be surrounded by hot water. When they are filled, the hot water is replaced by cold, to hasten the hardening and cooling of the candles. The machine contains a water distributor that works automatically in the following manner: A pipe, 18, delivers hot water in a distribution chest, 19, the hot water being supplied to the top space, 20. A plate, 21, is made to turn by the transmission, 30 to 34, the plate being perforated with holes, 37, that correspond with the piping, 30 to 48, the latter delivering at intervals in the chest, 17, surrounding the molds, 16. When the revolving plate, 21, closes the opening, 38, the hot water cannot flow to the chest, 17. The shaft, 30, continuously revolving, also works the distribution plate, 39, of a similar distributor, 40, to which the cold water piping is fitted, 41; the pipe, 42, takes the cold water through the junction pipe, 43, to the same chest, 17. The pipes for the outlet of each compartment end in a circular trough, *D*, keyed on the revolving shaft, *E*. The trough is divided into a number of compartments, according to the various temperatures of water used. Three compartments have been provided, for hot, lukewarm, and cold water; each one is fitted inside with a projection that raises the valve, *F*, at the end of the exhaust pipe, *G*, thus emptying the compartment. The pipes, *H*, of the feed overflow of each chest end above these compartments. The various divisions of the circular trough, *D*, empty through pipe, *K*, into circular runners, *L*, *L'*, *L''*; the water is then pumped up to the top of the machine. The whole of the water used is therefore saved separately, according to its temperature.

Fig. 3 shows the valve, *F*, on a larger scale. It consists of a box, *N*, inside which a flap, *O*, oscillates fitted to a rod, *P*; the pressure of the water in the chests forces the valve on its seat until roller, *Q*, at the end of the rod, *P*, is raised by one of the projections in the trough, *D*, above mentioned.

The machine works as follows: The driving shaft is thrown in gear, the cam starts its continuous revolving action, as does also the double distribution device for hot and cold water, the plungers of the left-hand chest being in their lower positions, as shown on that part of the section, Fig. 1; at this period hot water flows through the conduits, 38 to 48, to the chest, 17. Stearine is then poured in the molds in the center of which is placed the wick in the ordinary manner, the hot water immediately flowing out of the chest, which is afterward filled with cold water, through pipes, 42, 43, and 48. During the time required to harden the candles, the horizontal part of the cam maintains the plungers in their lowest position; the plungers then lift the candles from the molds, and hold them up until they are removed by the swinging device, 44. By acting on handle, 45, the shaft, 46, is made to turn around, the shaft being fitted with recesses that take the points of the candles; it is then only necessary to cut the wick to remove the candles from the machine.—Engineering.

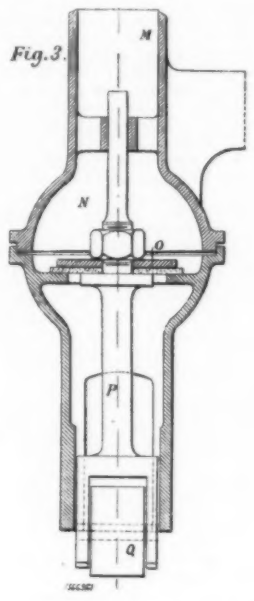


Fig. 3.

THE CARBIDE AND ACETYLENE INDUSTRIES IN GERMANY.

Germany has maintained and increased her early ascendancy in the carbide and acetylene industries. There are now probably about 8,000 acetylene installations, of all capacities, in Germany, says The Journal of the Society of Chemical Industry. Acetylene is now used in place of oil-gas for the manufacture of lampblack, of which it yields three to four times the quantity, of good quality. Acetylene is coming into use for driving gas engines; 160 liters develop 1 horse power, for the development of which 600 liters of coal-gas are required. The small weight of carbide needed for the production of a given illumination gives acetylene an advantage over other illuminants for colonial and military uses, where the cost of transport forms an important item. The high temperature of 2,700 degrees of the acetylene Bunsen flame renders it valuable for soldering purposes. For miners' and other portable lamps a portable acetylene generator is now largely used. Acetylene is also adopted in factories and other places where colors have to be distinguished and compared by artificial light. Investigations on the Elbe have recently shown that acetylene is very suitable for lighthouse illumination and for signaling at sea. Carbide containing a high percentage of phosphorus is useful for destroying parasites on vines.

Between 200 and 250 firms in Germany are engaged in carbide manufacture or acetylene lighting. The three firms having the largest amounts of capital invested in the business of acetylene lighting are the Allgemeine Carbid- und Acetylen-Gesellschaft, Berlin (£80,000); Herz Prometheus, Berlin (£60,000); and Falbe & Company (£50,000).

The carbide works established or in course of erection in Germany should theoretically yield about 9,000 tons of carbide per annum, while the German railways alone will this year consume about 8,000 tons. There is a large importation of carbide from other European countries; the value thereof last year was £110,000. Water power which can be profitably utilized is now nearly all taken up in Germany, and new carbide works there will have to use either steam power or the waste gases from blast furnaces. This last source of power is being rapidly utilized for the manufacture of carbide and other products, as is shown by the fact that the Dentz Engineering Works have delivered or

are constructing 30 gas engines for waste gases with a total of 13,100 horse power.

The price of carbide has fallen during the past year to such an extent that many works have been forced to cease producing it until the price improves. The depression is probably only of a temporary character. In the winter of 1898-99 the price of carbide in loads of about 10 tons at Hamburg was from 400 to 600 marks per metric ton; in October, 1899, it was 345 marks; in February, 1900, 310 marks; and in June, 1900, 265 marks. The reduction in the price of carbide seems to indicate that acetylene may become available for lighting larger towns than hitherto, i. e., towns of 5,000 inhabitants and upward. Even some of the small towns which now have acetylene installations supply the gas at a very low price for driving gas engines; e. g., at Ellerbeck the charge is 1s. 2½d. per cubic meter.

THE CALENDOLI COMPOSING MACHINE.

THE motto of modern industry is rapidity and economy. Such is the object that the innumerable machines that we see operating on every side permit of attaining. The hand of man will soon have no other function than that of regulating, through cocks and levers, the running of those machines from which come, automatically and uninterruptedly, the most diverse and sometimes the most unexpected results.

It was but natural that the daily press, seeking to satisfy the requirements of newspaper readers for quick information and for the very latest news, should have endeavored to profit by the great development of modern mechanism. It is for it that numerous inventors have attempted to revolutionize typography by the introduction of composing machines into printing offices. The Exposition of 1889 showed us several types of such machines, and particularly the Mergenthaler "Linotype." Since that epoch, this machine, constructed upon a larger scale, has been rapidly distributed throughout all English-speaking countries, and, in recent years, has been adopted by several French journals. It is the only composing machine, in fact, that has given the results that we have a right to expect from an apparatus of the kind.

Nevertheless, it is not particularly rapid, since it does not permit of composing practically more than 5,000 characters an hour. It is true that it justifies automatically and does away with distribution; but it is evident that, since composition is by far the most important part of typographical work, it would be of interest to have a machine that multiplied the speed of mechanical composition, without any regard to the other parts of the work. This is precisely what is accomplished by the Calendoli machine, the rapidity of composition of which is limited only by the rapidity with which the operator presses its keys. As in typesetting a production of 20,000 characters an hour is not exaggerated, it will at once be seen that so rapid a composition leaves a fine margin for manual justification and distribution.

We give herewith a representation of the machine, as a whole, as constructed by MM. Chateau and Savarse. The essential part of it is an inclined cylinder, composed of 100 steel plates, one meter in length, arranged at equal intervals and at right angles with the very straight and well polished surface. One of these plates is constantly beneath the vertical row of 90 type carrying magazines. These latter (Fig. 2) consist of I-rails, upon which the letters are held in a recess of special form. These letters are much shorter than the ordinary characters in use, as may be seen in the figure.

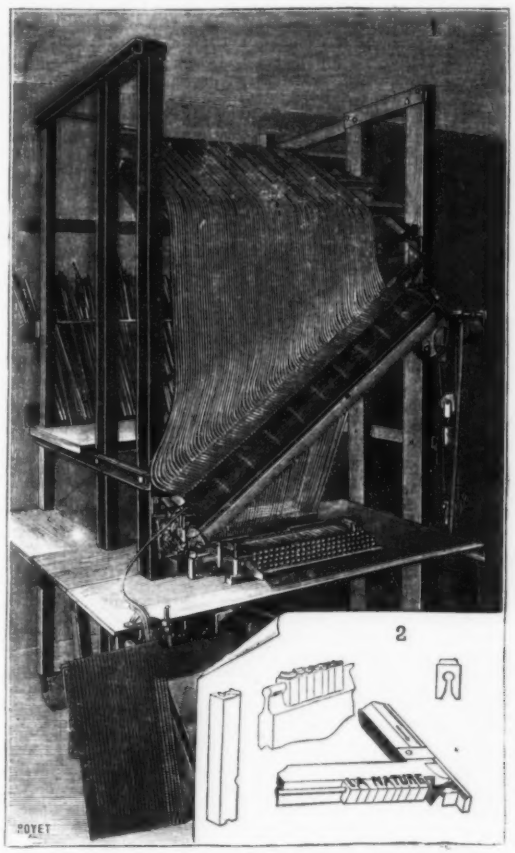
After the magazines have been filled, a man standing behind the machines recharges those of the latter that become empty by supplying them with movable magazines that are prepared automatically by the founding machine. One man suffices to keep five machines supplied.

The composing is done as follows: The plate-cylinder is inclined from right to left, while the magazines are inclined from left to right, so that the character leaving the magazine naturally falls upon one of the plates in a position that is nearly vertical. Reaching the bottom, to the left, it meets with a fixed rail forming an exact continuation of the plate. Engaging with this, it goes to place itself upon a wide galley that may be seen at the bottom and to the left in Fig. 1. Whenever a key is struck a character falls upon a plate of the cylinder, and the latter is moved forward one tooth by means of an escapement like that of typewriting machines, but acting upon a circular rack instead of a straight one.

As for the letter desired, that is forced from the corresponding magazine through pressure upon a sort of wedge, which detaches it from the column. In order to permit of such exit through pressure, the last letter of each magazine is simply pressed by the column of the following characters against a piece of copper along which moves the distributor. The rail of the magazine, in fact, does not extend all the way to this piece, but leaves a space a little wider than a letter between the two. It will be seen that the freeing of the letters is effected in each magazine according to the principle that permits all the pieces of a vertical pile of coins to drop in succession through the action of a knife held horizontally. As the general operation is the same as that of a writing machine, the composition may evidently be effected with all the rapidity that can be exerted by the operator, who has no need of any special knowledge of typography.

The Calendoli machine does not justify. It furnishes us with a large galley of characters arranged *upon* rails like those constituting the magazine. A proof having been pulled and corrected is sent to the justifier, along with the galley. Of this latter, placed to his right upon an inclined plane moved forward, line by line, by a typewriter escapement, the justifier allows the letters to slide upon rails of determinate length which will constitute the definitive page. Such sliding is effected through the intermedium of a fixed rail, a part of which has no foot. On the passage over such part, the justifier can easily make his corrections in accordance with the proof that has been sent to him. After the page has been justified, the printing may be done. This operation finished, the page is unlocked and all the characters are thrown into the melting pot of the founding machine.

Let us examine the Calendoli machine from a practical standpoint. Let us suppose that we have a composition of 150,000 characters to be executed in six hours. We select this figure six because we can hardly conceive of a pressing piece of typographical work



THE CALENDOLI COMPOSING MACHINE.

1. General view. 2. Actual size of an ordinary typographical character and of a Calendoli character.

taking longer. For composing and distributing 1,500 characters per hour, it will be necessary to reckon 16 ordinary typographers.

Upon employing the linotype machine, which, practically, cannot compose more than 5,000 characters per hour, it will require five machines to effect the composition and at least one complementary machine to make the corrections. It will require, also, six dactylographers, plus one mechanic who is acquainted with the details of the machine, say seven experts, who command large wages.

With the Calendoli apparatus, which is really a typewriting machine, a dactylographer is very easily capable of furnishing 16,000 characters an hour, so that two machines are amply sufficient for the composition under consideration. In reality it will take these two machines less than five hours to do the work required, and there will thus be effected a saving of 20 per cent over manual labor. During this time we shall have employed four justifiers by hand and two founders of characters, working for about eight hours; say a total of six persons, who will receive wages sensibly equal to those of the workers on the linotype.

Although the two systems may be considered as equivalent from the standpoint of manual labor, they are entirely different as regards material and the output of motive power and gas. With the Calendoli system we have but four machines in all, doing more work than seven linotypes, the net cost of which is higher, and the maintenance of which is more costly because of their greater complication.

On another hand, the motive power required by the linotype machines, which are twice more numerous, must be twice greater than that required by the Calendoli ones. As for the output of gas, that is incomparably less with the latter than with the former, since the latter use it only for the type-founding machines. To this should be added the fact that the linotype must always have in its furnace the heat necessary for the simultaneous fusion of the from 45 to 50 characters of an entire line, while the machines that supply the Calendoli cast but two characters at once. It is true that they operate a little longer, but there is no exaggeration in saying that they burn three times less gas for the same composition. It must not be forgotten that gas is very dear.

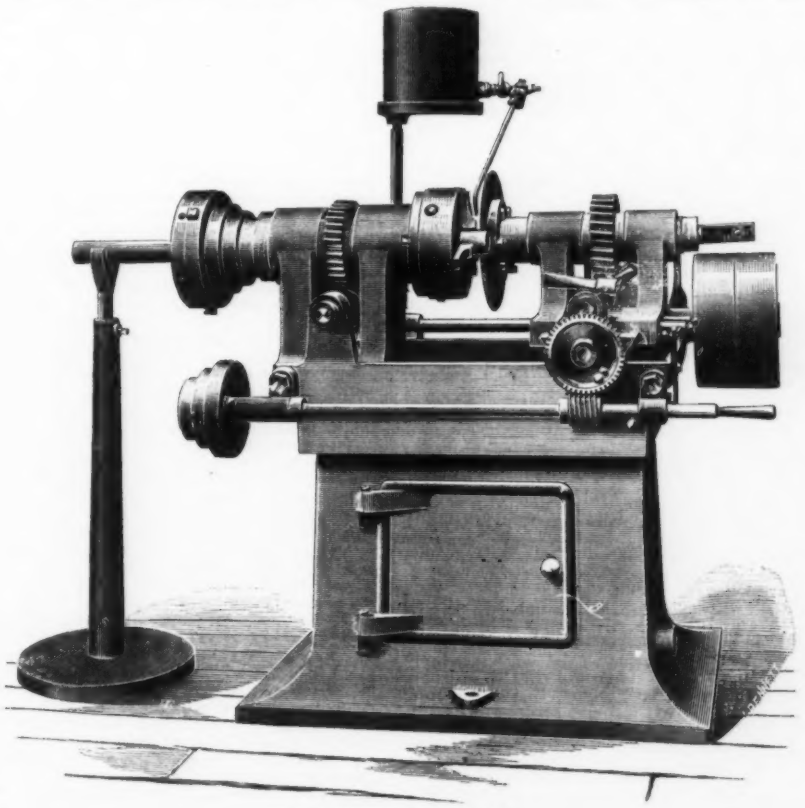
The saving effected by the Calendoli machine is greater still when we take into consideration the duplicate machines that must be provided for the linotype. At an epoch in which journalism has become one of the great social powers, and in which an organ has so much the more chance of being read in proportion as it can be composed later, it is evident that, independently of any question of economy, a machine that is capable of operating four times faster than others is called upon to render important services.—For the above particulars and the engraving we are indebted to La Nature.

COLD IRON SAWING MACHINE.

WE illustrate on this page a cold iron sawing machine, constructed by Messrs. Carter & Wright, of the Hexagon Iron Works, Halifax. As our illustration shows, the cutting is done by a circular saw, the stock operated on being gripped in a self-centering chuck of the usual type, and slowly rotated by gearing while the saw is at work. The cut made is, therefore, as square as if made by a cutting-off tool on a lathe, but is effected in half the time. The feed of the saw is automatic, and may be made at three different speeds. The fast and loose pulleys are shown to the right of the machine, and both the saw and the work are driven by worm gearing. A belt from the cone at the back of the fixed headstock of the machine drives the horizontal shaft shown to the front, and the latter, by the wormwheel shown, gives the feed to the saw. The machine is made in five standard sizes, the smallest of which will cut bars up to 2 inches in diameter, while the largest will saw bars up to 6 inches in diameter.—For the engraving and description we are indebted to London Engineering.

NET COST OF THE HORSE POWER HOUR WITH VARIOUS MOTIVE FORCE.

M. CHARVET, professor in the National School of Agriculture at Grignon, has published, in the twelfth installment of the "Dictionnaire du Commerce, de l'Industrie et de la Banque" (Yvres Guyot & A. Raffalovich, managers), an interesting and elaborate review of agricultural machines. We extract the fol-



SAW FOR COLD IRON.

lowing estimates, which ought to be included in the Aide-Mémoire des Practiciens:

A man, putting forth an average effort of 7 kilogrammes on a winch of 0.35 meter radius, works during 8 hours with the speed of 30 revolutions per minute. The price of the working day being 3.50 francs, the horse power hour will cost 4.20 francs.

A horse weighing 500 kilogrammes, attached to a gin of 4 meters radius, exerts an equivalent of 55 kilogrammes at the rate of 55 meters per minute during 8 hours. The day of the horse being valued at 4 francs the horse power hour will cost 0.97 franc.

An ox, working under the same conditions, exerts the force of 65 kilogrammes, at the rate of 40 meters per minute. The price of the day being counted at 3.50 francs, the cost of the horse power hour will come to 1.13 francs.

A steam engine (locomotive of 3 to 8 steam horse power, of high pressure, without condensation), the price of which varies from 1,000 francs per horse power for light force to 750 francs for medium force, consumes about 3 kilogrammes of coal per horse power hour. The net cost of one horse power hour furnished by a locomotive of 6 steam horse power, working 10 hours a day for 150 days, comes to 0.22 franc.

A petroleum motor consumes about 0.500 liter to 0.800 liter of petroleum or of gasoline per horse power hour, and costs from 600 to 800 francs per horse power. (The locomobile motors are of a little higher cost.) The net cost of one horse power hour may be estimated at 0.34 franc with heavy petroleum and at 0.38 franc with gasoline.

A windmill, developing a force of ½ to 3 steam horse power, and costing from 1,000 to 3,000 francs, makes the net cost of the horse power hour 0.11 francs.

A water wheel, whose price, including masonry and putting up, varies from 400 to 800 francs per steam horse power, makes the cost of the horse power hour come to 0.03 franc to 0.04 franc.

A turbine, varying in price, in the same conditions, from 100 to 500 francs per steam horse power, yields nearly the same result.*—Translated from L'Industrie Automobile.

THE FOOTHILLS OF COLORADO.

By H. A. CRAFTS.

WHILE the higher peaks of Colorado have been generously dealt with by the descriptive writer and scenic artist, I am inclined to believe that the foothills have been neglected. The lofty grandeur of the former has given them a world-wide prominence, and their transcendent beauties have been celebrated in song and story, and presented in glowing colors on many a canvas. In the railway literature of the day especially, they are constantly held up before the public eye.

But what the foothills lack in grandeur, they make up in extent, variety and picturesqueness. In fact, these are the qualities that stagger the writer who essays to describe them. For it must be understood that the great peaks of the Rocky Mountains do not spring suddenly from the level plains, and shoot thence above the clouds; but rather crown a mighty mountain ridge, more than two hundred miles broad, from base to base, looking down, both east and west, upon two immense slopes studded with these same foothills.

So the mountain climber, who starts from the plains with the purpose of attaining the highest pinnacles of the range, must needs make a journey of a day or two before reaching even their bases, unless, however, he be traveling by rail. And this preliminary journey pursues a constantly ascending grade, winding meantime through a perfect labyrinth of hills, of greater or less magnitude, and of an infinite variety of form and substance.

Starting from the plains, the climber first encounters the long and low ridges that skirt the base of the range in parallel lines. The outer ridge is composed principally of limestone, and slopes quite gently toward the plains, but is more rugged and precipitous on the opposite side. At intervals of every few miles, up and down the range, the ridge is intersected by clefts, or canyons as they are called in Colorado, some of which afford outlets for the numerous streams that come pouring down out of the mountain gorges, fed by the melting snows of the higher altitudes.

The canyons are quite narrow, their walls as a general thing quite perpendicular, and showing in fine array the various strata, forming the substance of the ridge. They are strewn with a profusion of huge fragments of broken rock, that dispute an entrance, save on foot or horseback. These, with the steep, rugged walls, would lead the observer to believe that the canyons had been blown out by some sudden and violent convulsion of nature; but even where they are not the outlets for natural living streams, springs are usually found above them, and even in the driest season small rivulets trickle over their rocky beds; and again, when sudden and heavy rain storms prevail in the mountains above, accumulated floods pour through them, with almost irresistible force, sometimes carrying upon their breasts the great bowlders that lie in their pathway; so upon second thought it occurs that these openings were really formed by escaping waters.

Doubtless, in the beginning, this ridge was a continuous whole, and for a time held lakes of pent-up waters. Then small leakages were formed, which grew by degrees, until the ridge was completely cut through, and the waters rushing through, spread themselves upon the plains; for the plains, contiguous to the canyons, are strewn with bowlders, myriads of pebbles and cobble stones, and the soils are largely mixed with sand and gravel, plain testimony to powerful floods in time past.

The slopes of this outer ridge of foothills give but small encouragement to vegetation. A thin coating of clayey soil, scattered over a bed of rocks, which have a propensity to stick their noses above ground, coupled with a naturally arid climate, is hardly propitious to plant growth. A few scrub pines, clumps of sage brush, some cactus plants, and bunches of soap weed, constitute the large specimens of plant life. During the season of showers and sunshine there is a growth of buffalo grass, that gives the hills a pale green tint, which turns to a light brown, as the grass becomes sere from long summer drought. And the grassy slopes, too, are spangled, in season, by a profusion of low-stemmed wild flowers, remarkable for their rich tints. In spots, larkspur grows quite luxuriantly, but it is quite a terror to stockmen, as cattle in the early spring, while the plant is young and succulent, frequently die from over-feeding upon it. So fatal are its effects that the plant is known as "poison-weed" among the ranchmen.

The inner slope of the ridge is here unbroken from base to summit, and there surmounted by a perpendicular crest of solid rock, resembling somewhat the rampart of a fortification. The cattlemen find these latter very convenient substitutes for fences in inclosing their ranges.

Crossing a narrow grassy glade we now come to the second line of foothills, almost identical in shape with the first. Its principal substance, however, is a stratified gray sandstone, which can be quarried in almost any required thickness, and is taken out in large quantities to be used for flagging, paving, curbing and building stone. This ridge, like the outer one, is intersected by canyons, which in some cases stand opposite to those in the first ridge and sometimes not, making a journey from the plains into the hills frequently devious, but nevertheless interesting. The inner flank of this second ridge is more precipitous than that of the first, and for long distances reveals the various strata of stone, each having a color or tint of its own. There are delicate grays, drabs, browns and pinks, which lying in long undulating bands, present a very pleasing aspect of variety and richness.

The third ridge is composed of red sandstone, not stratified like the gray, but lying in immense masses, with here and there a seam dividing one ledge from another. This stone is found to be well adapted for building purposes, and is quarried in large quantities for structural work. Here again are found the intersecting canyons, and the sharp interior declivities of the second ridge, and the pictured walls are even more marked, the lines of color running both vertically and horizontally. The shades run from a light buff to a chocolate brown. For miles these alternate parallel ridges and glades extend up and down the base of the great range in gently curving lines; also in coloring and contour there is general softness. The reddish tint predominates, even when the grass is at greenest, a fact attributable to the general presence of iron ores, which exist to a large degree in the shape of hematites. These color the rocks, the sands and the clays. But when the grass turns brown the ruddy tint is deepened, especially when seen in the mellow light of an autumn day.

Winding all through these glades and canyons are numerous wagon roads and bridle paths where the lover of nature may wander at will, feast his eyes upon a thousand beautiful vistas and have his attention attracted by a multitude of interesting objects. Some parts of the glades are as smooth and grassy as a well-kept lawn, and from their midst gush springs, embowered in groves of cottonwood trees, willow or quaking asps, and bordered by tall grasses and luxuriant growths of wild flowers, that bloom brilliantly during the spring and summer seasons.

Odd and bizarre bits of scenery spring up on every hand. On the crest of some ridge curiously shaped rock formations are outlined against the clear sky—a human profile, a line of chimneys, a column, a pyramid—with stunted pines and cedars throwing frosy heads against the blue background. From the midst of a smooth, grassy slope springs a single huge rock, and farther on a lone and starveling willow, gnarled and twisted out of shape by buffeting winds and parching droughts, languishes in a sterile soil. Half-mournful, half-weird, almost purely exotic, but exquisitely beautiful, are some of these views; worthy to be limned by a Beardsley.

Of animal life these precincts are by no mean destitute. Largely in these modern times the hills are utilized as pasture lands and their slopes are dotted with grazing kine. But it is of wild life that we have to deal, and if we look up and down the glades and in the cracks and crannies of the rocky ridges we shall find it in abundance. In the clumps of wild plum trees and chokeberry bushes the air is made vocal by the chatter of magpies and blackbirds. Then the ear is occasionally greeted by the cry of the bluejay, which by the way is rather a late comer to Colorado. Of smaller birds there are bluebirds, wild canaries, cardinals, etc., flitting among the branches. Then there are ground owls and hoot owls, the former being on quite familiar terms with the prairie dogs while the latter occupy grottoes high up in the rocky cliffs. Of furred animals there are the well-known prairie dogs, ground hogs, mountain rats, squirrels, wolves, coyotes, etc., who cultivate a more or less intimate acquaintance with the wayfarer and add life and animation to the scene.

But above and beyond these outer rims of the Rockies begins the true wonderland of the region. There is a vast succession of hills and valleys, crags and canyons, meadows and streams, until the great timber belts of the higher altitudes are reached. The hills are more broken, more varied in form, more rocky and more massive. Some are rounded in form and quite bare, save of rocks and a few scattering pines. Short grasses grow thinly upon their slopes, which are grazed summer and winter by innumerable kine. Others are abrupt, steep and craggy, and tower grimly against the sky. The grand canyons are deep, and in some places very narrow, while the tributary canyons lead up into all manner of secluded and picturesque regions—narrow rocky gorges, verdant meadows or forest arbors of pine and spruce. It is a region that is exceedingly well watered, the natural flow from multitudinous springs and from an occasional rainfall being augmented by the melting snows of the alpine heights. These streams are quite plentifully peopled by mountain and brook trout, whose ranks are being added to year by year by the State fish hatcheries; so that the tourist, who has piscatorial leanings, may have his fill of sport while on his summer outing.

Despite the rough and rugged nature of the country, these are essentially regions of light and cheerfulness. This is largely due to the dryness of the climate and the superabundance of sunshine. Barrenness is also a predominating feature, permitting nearly every nook and corner to be entered by the sun's rays, and to be breathed upon by the light and capricious breezes that blow almost constantly over the hilltops and through the network of narrow valleys that cover this portion of the range. There is almost an utter absence of gloomy gorges, miasmatic swamps or barren mountain wastes. On the contrary, there are green and sunlit slopes, that stretch far up to pine-clad summits, the sun's rays filtering with fine effect through the canopies of green boughs; level and park-like glades, growing luxuriant grasses and wild flowers, and studded with pines and aspen groves; and flanked perchance by high cliffs of ragged gray rocks, which reflect warmly the brilliance of the sunlight and over against which the liquid heat-waves may be discerned, trembling against the rocky background in delicate undulations; clear and crystal streams that tumble noisily down stormy declivities, or wind silently through narrow meadow lands, embowered in alder trees and silver spruces, whose branches look as if they had been freshly powdered by fairy hands; a hillside with grassy plots and rocky ridges, looking for all the world like a New England upland farm transplanted among crags and peaks, for as the hill rises there is a transition to bald ledges, and finally to granite precipices with clumps of pines finding scant foothold between the crags; or far-reaching vistas, stretching mistily into the distance, with rocky headlands jutting into view, that require but a mild stretch of the imagination to picture as castles.

Yet how difficult it were to classify the varying features of this great region! Take a single sequestered valley, and a volume might be written, and yet there would be undiscovered wonders! Then how herculean were the task of unfolding the wonders of an entire mountain tract!

A brief description of a single highland lake and then the present essay must end. Chamber's Lake lies at the headwaters of the Cache la Poudre River, in northern Colorado, at an elevation of ten thousand feet above sea level, and fifty miles from the outer foothills at the eastern base of the range. It is set deep in the embrace of a group of steep mountains. It has been sounded to a depth of more than three hundred feet, yet there are depths that have never yet been touched by the plummet. Its waters are as clear as crystal and so translucent that the bottom of the lake is visible many feet beneath the surface. Wild and romantic regions are on all sides. From its northern borders steep, pine-clad mountains rise to an imposing height; yet above these towers the snowy summit of Clark's Peak, which reaches an altitude of more than 13,000 feet above tide water. Down the slope of one of the lower heights pours an impetuous stream, known as Fall River, whose muffled brawl is echoed far across the blue waters of the lake.

The atmosphere round about is highly rarefied and of the utmost purity, and under clear skies the surrounding peaks stand forth in vivid outline. Over all reigns the hushed breath of high altitudes, and no sound breaks the silence save the murmur of the winds through the pine forests and the louder voice of Fall River as it thunders down the opposite steep. Southward, as far as the eye can reach, the snow-capped peaks of the main range stand in seemingly endless procession against the melting skies. Eastward the grand canyon of the Cache la Poudre plunges down into a mass of rugged hills that stretch far toward the great plains. Taken all in all, it is a scene of surpassing grandeur, and one calculated to rouse the awe and admiration of the most sordid.—Popular Science News.

THE CANALS OF MARS.

By Miss M. A. ORR, in Knowledge.

THE physical condition of Mars is a problem over which discussion still rages with unabated vigor. While Mr. Lowell sees in the Martian "canals" a vast system of artificial irrigation, and M. du Ligondès geological fissures, through which rise to the frozen surface vivifying vapors from a still heated interior, M. Antoniadi ascribes their doubling to a defect in focusing, and others disbelieve in even their single existence. But the enigmatical lines have appeared to so many, and in the main with such consistent similarity, that the ranks of these unbelievers grow thin. Between rejecting the canals altogether, however, and accepting them as actual physical entities, there are other possible alternatives. Mr. Walter Maunder, in an article in Knowledge for November, 1894, and more recently Signor Cerulli, in recounting his observations of Mars in the opposition of 1896-97, at his private observatory of Collurania (Teramo), showed how the mathematical lines and spots we find in the faint markings of Mars might be merely the easiest form in which, with our present optical means, we could be cognizant of its real features. This latter treatise elicited replies from Schiaparelli and Flammarion, but their arguments in favor of the physical existence of the markings as such, and of actual changes taking place in them, are not altogether conclusive. Signor Cerulli's observations during the last opposition have confirmed him in the belief that the markings are optical, and his new report* is substantially a full exposition of his theory. These observations extended from August, 1898, to March, 1899, and were made with a 15½-inch Cooke equatorial, with powers of 400 and 500, always without stops or colored screens, the object being not to get sharp definition of any special feature, but as complete a picture as might be of all the phenomena. The author shows what is the explanation, on his theory, of the features seen and their apparent variations, and brings forward ingenious and novel arguments to prove his case.

It must be remembered that in a bird's-eye view of a world some forty millions of miles away all we can take note of are contrasts in tone and color, while the

* The steam horse power in French calculations, which is 736 watts, is less than the horse power in English and American estimation, which is 746 watts, or the equivalent of 1,014 steam horse power.—*Note by Translator.*

* Nuove osservazioni di Marte: Saggio di una interpretazione ottica delle sensazioni areoscopiche. By V. Cerulli. Collurania, 1900.

real contour of objects is masked or invisible. Small or faintly-shaded objects, invisible singly, will produce an effect, if close together, of one large mass, and from our inability to see the irregularity of their grouping, will appear as round spots or long streaks. But conditions of seeing vary enormously on Mars, according to its distance and position, and the changing illumination of its disk; not to speak of variations in ourselves, our atmosphere and our instruments; the contrasts, therefore, will vary, more detail will sometimes be seen in the patches and streaks, fainter markings at their edges will appear and disappear, altering their outline and extent. The hazy aspect of Schiaparelli's canals may thus be a nearer approximation to reality than the sharply defined, and the doubling may be due to disappearance of faint shadings between more easily grasped boundaries. That the canals were discovered after the opposition of 1877, being only suspected during the most favorable period, that they are sharpest with colored screens and comparatively small apertures, while in the great Lick and Washington telescopes they have been seen either as few diffused markings, or not at all, suggest that the fine lines are simply a mode under which faint markings may present themselves to imperfect vision. There is undoubtedly truth in the apparent paradox that greater distinctness comes with poorer vision, for in the best moments the eye dimly perceives, even where it cannot grasp, divisions in simple masses, curves and blurring in narrow lines, indeterminate shadows in clear spaces.

Whether the optical theory accounts for *all* the variations, including those of the polar caps, the future must decide. Most interesting is Cerulli's appeal to the past history of areography, referring to Flammarion's valuable collection of drawings, all carefully copied from originals, in his "Planète Mars." Here we may see how in the first rude telescopes impressions of Martian markings were summed up in one large round spot, or one wide band, which latter was by Cassini and some others seen double. By degrees the easiest features of the southern hemisphere were distinguished, but appeared so variable that an atmospheric origin was ascribed to them. It is particularly instructive to compare Knott's drawing of November 3, 1862, with Lord Rosse's of three days later. Knott's telescope was of 7 1-3 inch aperture, and the features which in the 6-foot Rosse reflector appeared as large dark patches on a fainter background, he portrays as narrow lines on white—canals on a large scale. Again, in two excellent drawings by Kaiser, a broad band where we now recognize Praxodes, seen at the opposition of 1862, becomes, six weeks later, when seeing was more difficult, two narrow bands with faint shadings between. Other examples of gemination in lines and in spots, contractions and enlargements, etc., may be traced and through all the series there is a remarkable, but in no wise astonishing, variety of representation. One has but to consider the fugitive faintness of the objects, the imperfections of the instruments, and the personality of the observers, which affects not only their vision but their mode of portrayal. On this last point, which comes out very clearly on an examination of the illustrations in "La Planète Mars," Signor Cerulli has not perhaps laid enough stress, nor on the influence of unconscious imitation.

Mr. Green, the artist-astronomer, used to insist on the importance of the trained hand as well as the trained eye in order to obtain true pictures of planetary detail.

Is the history of discovery with regard to the large markings in Mars' southern hemisphere repeating itself now with the more delicate shadings in the northern? and with better optical means would they also lose their misleading appearance of mathematical regularity, and their instability?

The artificial origin of the Martian "canals" can hardly be maintained now that they have been seen to traverse the polar caps, and to appear in Venus, Mercury, and two of the Jovian satellites. On the optical hypothesis, on the other hand, this is precisely what we might expect. It is perhaps going too far to suggest that the bands of Jupiter and their varying appearances are strictly analogous to canals, since their atmospheric origin is rendered probable by other considerations, notably by the planet's low density; yet there is certainly a startling resemblance between some early drawings of Mars and recent diagrams of Jupiter. Schröter's Mars, for instance, on page 77, Fig. 48, of "La Planète Mars" (1892 edition), tempts one to quote Dante:

> "Such would Jove become, if he and Mars
> Were birds, and changed their plumage."*

We are indebted to M. Flammarion for another line of evidence. He had the happy idea of collecting naked eye views of the moon by different observers, and in response to his appeal an interesting series appeared in the "Bulletin de la Société Astronomique de France," from January to June of last year. The disk of the moon to the unaided eye is about the same size as that of Mars in an average telescope, but the conditions are not quite the same, as naked eye vision does not admit of straining and mis-focusing to the same extent as telescopic. Nevertheless, the study of these drawings is, as M. Flammarion remarks, a lesson on the value to be attached to observations at the limit of visibility, and no one would have believed that the same thing could have been represented in so many different ways. The reader may judge for himself by personal examination whether these drawings support Cerulli's theory of the canals. He will not fail to observe a tendency to draw the Seas of Serenity, Tranquillity, Plenty, and Nectar, as two lines more or less parallel, while the Ocean of Tempests is sometimes a narrow curved line, its eastern border only being seen, in contrast with the brilliant limb. Tycho in one instance appears a very large bright *square*.

Whether the optical theory be correct or no, probably no one will deny the wisdom of Signor Cerulli's advice to regard all Martian maps as temporary guides, sure to be modified by further investigation. We may add, however that to refrain altogether from speculative hypotheses would be as unscientific as uninteresting; the sensational theories about Mars have been a stimulus to much excellent work; but the scientist remembers that they are only theories, and is prepared to see them dispelled by fuller light.

* Qual diverebbe Giove, s'egli e Marte
Fossero augelli, e cambiassersi penne."—Par. xxvii. 14, 15.

INFORMATION CONCERNING THE ANGORA GOAT.*

THE goat has accompanied civilization into all parts of our country—not numerously, but persistently. He is everywhere, and is well known. There are very few people who have not seen a goat, and there are fewer still, no doubt, who have seen many goats. The comic writers, playing upon his peculiar habits, have brought him into disrepute, although these habits, to a large extent, are such as are recommending him for special favor at this time. His fame is as a denizen of vacant lots and back alleys, subsisting upon anything or nothing, and a foe to everything. So far as the general public is concerned, he has not been reckoned with as a useful animal and has been tolerated only as a pet for children.

ORIGIN AND HISTORY.

The purpose of this paper is to give prominence to those phases of the Angora goat industry that are of practical importance; therefore a brief space only will be devoted to the history of the breed.

Naturalists generally agree that there are about ten species of wild goats, all confined to Europe and the Himalayas of Asia. These are divided into two groups, as follows:

I. The ibexes.—These, according to Hayes, have, as a distinctive characteristic, horns "flat in front, with a horizontal triangular section, furnished with large transversal knots."

II. Goats proper.—These, according to Hayes, have horns "compressed and carinated in front," and, according to Wood, "may be distinguished from the ibex and the sheep by the peculiar formation of the horns, which are compressed and rounded behind and furnished with a well-developed keel in front."

The Angora breed of goats originated in the vilayet of Angora, in Asia Minor, but it is not known when this was. Some have ventured to say that it was

MADAME LADYSMITH, THREE YEARS OLD.

Fleece, 8 pounds. (Photograph furnished by C. P. Bailey & Sons Company, San Jose, Cal.)

2,400 years ago. There is pretty strong evidence which goes to show that they were a distinctive breed when Moses was leading the Israelites out of Egypt. Goats' hair was spun by the Israelites for curtains and other purposes for use in the temple. In the story recorded in I. Samuel (chapter 19) of the artifice of Michal in deceiving the messengers of Saul by placing an image in the bed in place of David and giving it a pillow of goats' hair, is believed by Pennant to refer to a pillow made of the Angora fleece.

The city of Angora, or Enguri, the capital city of the vilayet of Angora, is the ancient Ancyra, and is located about 220 miles south by southeast from Constantinople. Angora was the seat of one of the earliest Christian churches, and was probably established by the Apostle Paul. The province is mountainous to a considerable extent and furrowed by deep valleys. It is about 2,900 feet above the level of the sea.

It was here that this famous goat reached its perfection—and such a state of perfection as has not yet been reached by the goats of either the Cape of Good Hope or the United States. That the altitude, the soil, or the climate, or all of them together, had much influence in producing this fleece-bearing goat is supported by strong evidence. Dr. John Bachman and the Encyclopædia Britannica both state that the fineness of the hair of the Angora goat may perhaps be ascribed to some peculiarity in the atmosphere.

Mr. Henry O. Binns, who had about twenty years of experience with these goats in the vilayet of Angora, says the pure animals were about bred out in 1863. The reason for this was the extensive crossing with the common Kurd goat, reference to which has already been made. As early as 1839 there ceased to be a demand for the spun yarn of Asia Minor, owing to the fact that Europe could spin the yarn at much less cost; but there was a European demand for the raw hair which exceeded the supply. This condition of things led to complications and a mixture of breeds from which the mohair world has not yet recovered. There can hardly remain a doubt, however, that, with the recent renewed interest in the industry, and with the intelligence that the breeders will bring to bear, the Angora goat industry will soon be placed on the highest plane.

The history of the Angora goat in the United States has been marred by the carelessness or indifference of occasional writers for the press who have been often inaccurate as to dates or facts, and also by others whose interests have doubtless led them into exaggerations.

During the administration of President Polk, the Sultan of Turkey requested of him that he recommend some one who would experiment in the culture of cotton in Turkey. Accordingly, Dr. James B. Davis, of Columbia, S. C., was recommended, and he received the appointment. The work done by Dr. Davis appeared to be highly gratifying to the Sultan, and so, upon his return, in 1849, the Sultan, desiring to reciprocate the courtesy of the President, presented him with nine of the choicest goats in his dominion. Col. Richard Peters, writing in 1876, says of these animals: "These doubtless were selected from the herds of Angora, a district of country lying among the Taurus Mountains, which traverse Asiatic Turkey, and which derives its name from its principal city, situated about 200 miles east of Constantinople." It does not seem, therefore, that Dr. Davis encountered any great difficulty in securing this first importation of Angora goats into this country.

Of the nine Angoras imported by Dr. Davis, seven were does and two were bucks. Besides these, according to Colonel Peters, there came in the same lot one purebred Tibet doe, several head of crosses between the Angora and Tibet goats, and quite a number of grade does bred from the common short-haired ewes of the country and his Angora bucks.

The soft undercoat of the Cashmere is known as "pashum," and is the product from which the famous Cashmere shawl was made. Mr. William M. Landrum, who was probably the first in this country to discover that our so-called Cashmere goat was the Angora instead, through investigations made about 1861, also states that there is a difference between the Cashmere shawl and the Paisley shawl. These are often referred to as being the same shawl. While the filling of both shawls was of pashum, the chain of the latter was made from the kid fleece of the Angora. Pashum is combed out in the spring, and is worth, when cleaned, in the country where it is produced, from $1.50 to $2 per pound.

DESCRIPTION OF THE ANGORA GOAT.

Mr. Israel S. Diehl, bearing a commission from the Commissioner of Agriculture, visited the province of Angora in 1867 to investigate the mohair industry. Here, where there were once in operation 1,700 to 1,800 looms, working up the mohair fleeces, he found but a few hundred remaining, struggling hopelessly against the fatal competition of European machinery and the aggressive policy of the European governments. The fleeces were exported to Europe for fabrication, thus rendering Turkey tributary to the monopoly then existing in this industry in Europe. The European demand for the raw material was so great and the facilities to fabricate it so much better and cheaper that Turkey was compelled to export the raw mohair. In order to meet the demands for manufactured mohair the Turkish growers, without wise foresight, began the practice of crossing the Angora upon the common Kurd goat of that country. The inevitable result of such a policy was to bring about to a large extent the conditions which have obtained in the United States, namely, a breed of Angoras of uncertain purity. This fact, coupled with the belief that proper care was not exercised in selecting the animals exported to this country and that they have been carelessly bred here, has led some excellent judges of Angoras to express the belief that there are really no purebred Angoras in the United States.

These conditions have produced various types of Angoras, even in Asia Minor, and a minute description of one would not apply to all. Some strains have fox-like ears, while others and generally preferred ones have long pendent ears. In this country care must always be exercised to cull the offcolored kids out of the flock. These may be the result of atavism, where a cross was made upon a common goat either red or black; but it is reported by some that different colors are found in the province of Angora among what were supposed to be purebred animals. Mr. Gustav A. Hoerle, one time corresponding secretary of the American Mohair Growers' Association, and an

* By George Fayette Thompson, Editorial Clerk, Bureau of Animal Industry. Abstract of Bulletin 27 of the Division of Animal Industry, Department of Agriculture.

authority of note on Angora goats, mentions having yellow and red goats in his own herd, and said that "some of the kids became quite a variety show."

Probably the best description of the American Angora is that given by Mr. Gustav A. Hoerle, which is given below. Reference is to first-class animals, and not to grades of various degrees:

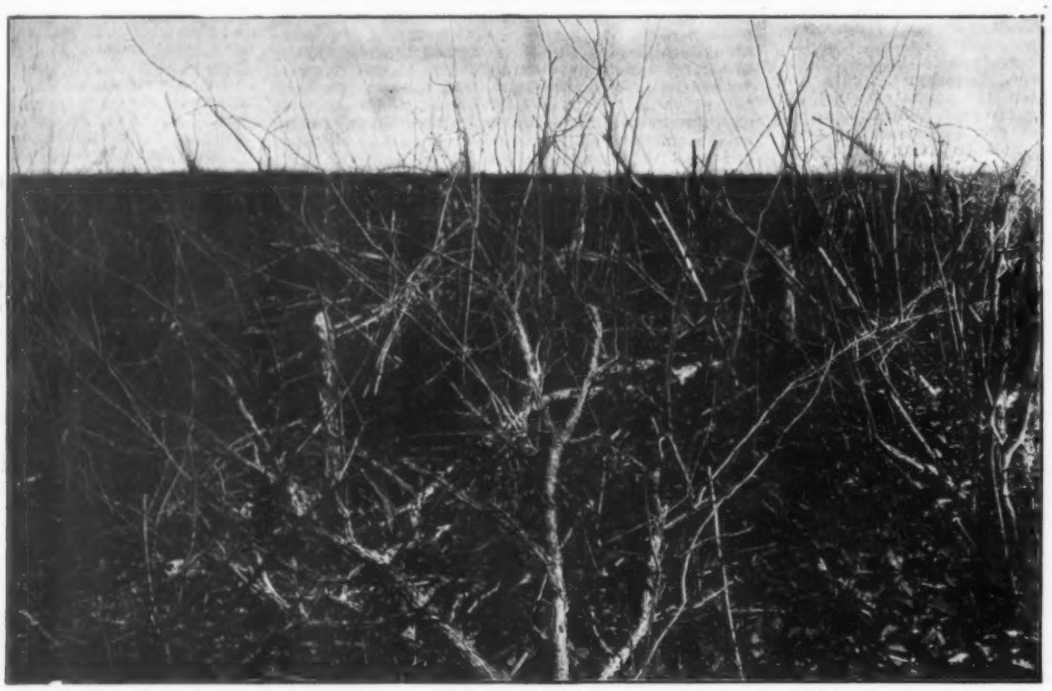
The body should be long, and the rounder the better; the back straight, with shoulders and hips equally high from the ground; shoulders and quarters heavy and fleshy; chest broad, indicating good constitution; the legs should be short and strong; the head is in shape like that of a common goat, but less coarse and cleaner cut; the horns are heavy, with an inward twist, inclining backward and to the outside.

Except just the face and legs, from the hocks and knees down, the entire animal should be densely covered with mohair, and neither the belly nor the throat nor even the lower part of the jaws should be bare, but should have a good covering of fine, silky mohair, and with the finest specimens the mohair tuft on the forehead should be well developed. The mohair should hang in long, curly ringlets. However, not every Angora goat which shows these perfectly curly ringlets of the mohair must necessarily be considered a thoroughbred; while, on the other hand, there are quite a number of really handsome and valuable thoroughbreds whose hair has not that much-desired shape, owing entirely to climatic and nutrimental influences, as well as to advancing age. Thoroughbreds and all nonshedding grades can easily be recognized by the peculiar shape of "points" of their mohair, each end showing plainly that it has been "cut off," instead of running gradually to what is called a "steeple point," which is found with the hair of all kids and of shedding grade Angoras. The plainer and longer this blunt point shows toward the end of the year the better is the fiber of the mohair, and the more valuable is the hair for combing purposes and the smaller the percentage of noilage and waste. After shedding, as well as nonshedders after shearing, the mohair grows very rapidly for some months. It grows slower toward the end of the year, and, with very bad climatic and nutrimental influences, almost stops growing entirely. Therefore, if the late fall shearing is practised, Angoras need good care during winter. The more even in length and quality the mohair is on all parts of an Angora body the better. When in full fleece the body of a fine thoroughbred Angora should appear like a right-angled square, with no gaps or deficiencies of covering, especially below the belly.

A characteristic of the common goat that is very objectionable is the ever-present offensive odor from the bucks; in the Angora breed this odor is entirely absent, except at the rutting season, and then it is noted in a slight degree only. The odor in a fleece of mohair is milder than that in a wool fleece, and is not at all offensive.

THE USES OF ANGORA GOATS.

A large class of people in some way have become possessed of the opinion that the goat is practically a useless animal. They do not reach conclusions upon investigations, however, and do not discriminate between the different breeds. To them a goat is a "goat," and there the argument ends. Investigations prove that the Angora goats are not only classed among the most useful of the domestic animals, and have been so classed for thousands of years, but their usefulness is manifested in a variety of ways. The fleece, called "mohair," furnishes some of the finest of fabrics among ladies' goods and is used in various other manufactures; their habit of browsing enables the farmer in a wooded locality to use them to help in subjugating the forest; their flesh is exceedingly delicate and nutritious; the milk, though not so abundant as with the milch breed of goats, is richer than cow's milk; their tanned skins, though inferior in quality to the skins of the common goat, are used for leather; their pelts make the neatest of rugs and robes; they are excellent pets for children; a few of them in a flock of sheep are a protection from wolves and dogs; their manure is noticeably helpful to the grass which follows them after they have cleaned away the underbrush. These are all vital subjects of varying degrees of importance, and will be considered here under appropriate heads.



BRUSH LAND "DURING GOATING," AFTER TWELVE MONTHS.

(Photograph furnished by Dr. J. R. Standley, Platteville, Iowa.)

Browsing and Pasturage.

Ability to clear brush land.—Goats are browsers by nature, and there is no vegetation they will eat in preference to leaves and twigs of bushes. While this fact would at once establish them as an intolerable nuisance in an orchard or garden or any other place where desirable shrubbery is growing, it also shows that they may be of great value in many localities where it is desirable that underbrush be destroyed. They are omnivorous eaters and seem particular to avoid that character of vegetation which other kinds of live stock prefer. Every leaf and every twig within their reach is greedily eaten, even to most of the bushes and weeds that are considered poisonous to other ruminants, while a remarkably few weeds are passed by. They will desert the finest clover and blue grass for such an outlay.

The inherent tendency to climb leads them to hillsides and rocky cliffs, and they prefer such situations

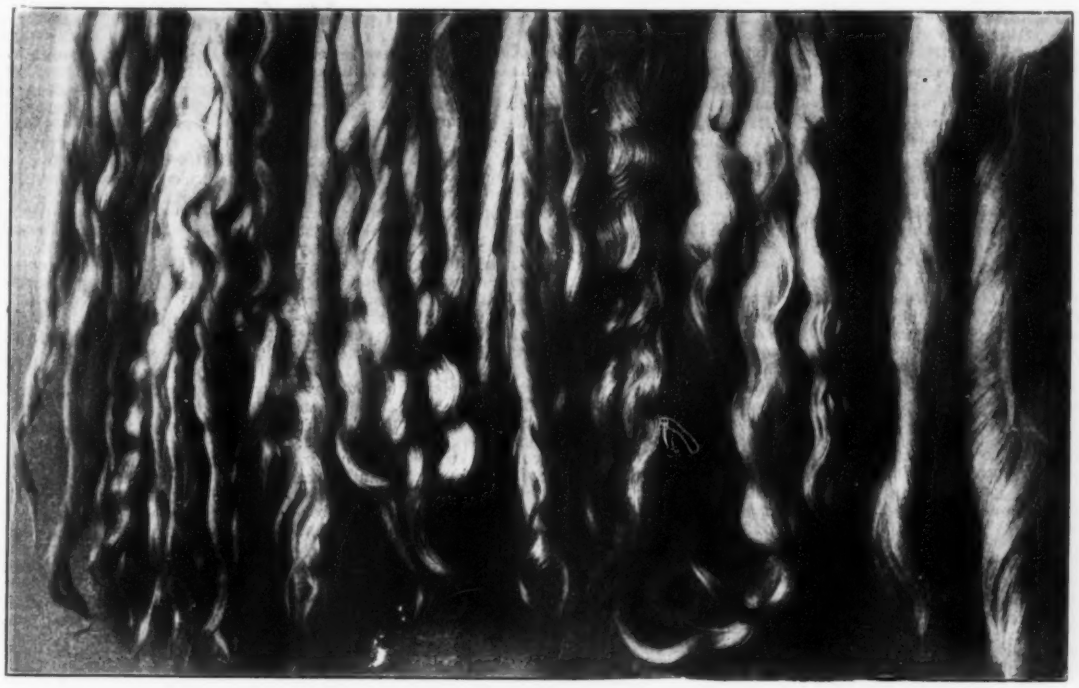
BRUSH LAND "AFTER GOATING" TWO YEARS.

(Photograph furnished by Dr. J. R. Standley, Platteville, Iowa.)

to any of a level character. Here nature meets their necessities by dwarfing the bushes so they may be browsed easily; the soil is quickly drained in the event of rain—for they do not like wet land; and the stones serve to keep the feet trimmed properly by the wearing process. This is the situation that the goats would choose; but the farmer might choose to turn them into a dense mass of brush and weeds anywhere and they will at once begin to convert it into the most beautiful pasture.

In those localities where valuable land is completely subdued by brush the goats are considered of more value for the purpose of clearing it than for their mohair or meat. They thus become one of the farmer's important tools. Their value in this respect must be measured by the value of the land which they will render cultivable. It is said that in Oregon, where Chinamen had been paid as high as $20 an acre for clearing off brush, goats had done the work even better. Sprouts will spring up behind men's work, but goats will keep them down until they cease to appear. True, the goats require more time than men, but their work is better. In this connection an article which appeared in The Country Gentleman of January 11, 1900, is of special interest:

In 1870 Mr. Landrum exhibited ten head at the Oregon State fair. They were put in a brush pen, where they ate out the brush and peeled the saplings during the fair. As the Willamette Valley was covered with brush and farmers were paying Chinamen $20 and Americans $22 per acre for grubbing, Mr. Landrum suggested the employment of goats instead; and, to demonstrate their effectiveness as substitutes for grubbing, he left them on 3 acres of slashed brush. At the end of the first year the roots were dead and discolored, and at the end of the second year they were rotten and the land mellow for the plow. Then he drove up his California herd of 2,400, the result of fifteen years of breeding, and sold them in small lots from Jacksonville to Portland, scattering them throughout the Willamette Valley. He says he sold as many more later to go to Oregon, where there are now 80,000 head, mostly in lots of 25 to 300. . . . He believes that they are more profitable than any other farm animal. They have cleared hundreds of thousands of acres of brush land in Oregon now in cultivation.



SAMPLES OF MOHAIR.

(Photograph furnished by Harris & Baylor, Montell, Texas.)

Through the courtesy of Dr. J. R. Standley, of Platteville, Iowa, some illustrations are presented which show woodland during goating, and after goating. Words cannot possibly emphasize the work of goats as brush destroyers so strongly as these illustrations.

The first shows a piece of land while goats were operating on it. It will be observed that the brush is dead, and that the weeds only appear to be alive. The second shows the "finished product" after two years. The goats had been in the tract shown but twelve months when this photograph was taken. The shrubbery that was too large for the goats to "ride down" was cut down, the goats completing the work by eating the soft twigs and leaves. The last piece is ready for cultivation or for pasture for cattle, sheep, or horses.

The beneficial effect of the goats is not all in the clearing of the land of brush. In many parts of the country nutritious grasses "come in" after the goats have done their work. In the tract shown ("After Goating") blue grass has by natural methods formed a most excellent pasture. The final result is that the goats not only put such character of land in condition for cultivation, but actually go further by converting a wilderness into a good pasture, thus preparing the way by cheapest methods for sheep, cattle, or horses.

Dr. Standley says that in that part of Iowa where he lives "100 Angoras to each 40 acres of this land for two years would make it as clean as a lawn and as perfectly set in blue grass as a lawn." He has 500 acres of such land cleared in this manner. This land now supports one steer to each acre, whereas before it was cleared there was not enough grass on an acre to make a sheep or goat a single feed. The same experience is reported by Mr. Q. M. Beck, of Beargrove, Iowa, who says: "After running them on such lands here a few years we have a fine blue-grass pasture."

Dr. Standley's experience in the employment of goats for clearing land is extensive, and thousands o goats have been taken into Iowa upon his recommendation. It will interest the readers of this paper to see the following from his pen:

Land can be cleared of the worst brush known to this country for a little less than nothing by Angora goats. Some one asks how. Simply this: Angora goats will pay a profit and live on leaves and weeds, leaving the land clearer and nicer than can be done in any other way. Many persons have the idea that goats bark the trees and in that way kill them. They also think that goats wholly eat the hazel and other small brush. There is nothing in this. Goats are no worse to bark trees of any kind than sheep. The way in which goats kill brush is by continually cropping the leaves, which serve as the lungs of the brush. The continual cropping of the leaves makes the brush, as it were, sick, caused by lack of nourishment. This sickness sinks to the very extremity of the roots, thus preventing sprouting. Any and all kinds of bushes are in this way

Fleece, 9 pounds. Fleece, 5½ pounds. Fleece, 6 pounds.

ANGORAS, SHOWING FLEECES OF SEVEN MONTHS' GROWTH.

(Photograph furnished by Harris & Baylor, Montell, Texas.)

easily killed. Some kinds of brush and some kinds of stumps are of course much harder to kill than others. Many varieties are entirely killed by one summer's trimming of the leaves. Almost any are killed by two years' trimming. To clear the worst brush do not cut anything that the goats can reach or bend. The tallest or largest is better not cut. All trees and saplings should be cut, and the goats will keep all the sprouts down. If stumps are allowed to sprout one year before the goats are turned in, the sprouts need not be cut. About 200 goats for 40 acres of brush will in two or three years make the land as clean as a garden. If the pasture has only patches of brush, turn in a few goats and it will make more grass for other stock than if the goats were not in. They eat very little grass when they can get leaves. Goats even like weeds better than grass. In clearing brush land in the old way by grub and plow there are always left many eyesores in the way of brushy nooks and bends and steep places which cannot be plowed.

There are millions of acres of land in nearly every State in the Union which might be much more than doubled in value by the use of Angora goats at no cost at all. Commence and count the worth of your land, then the fencing, and see if you can afford to leave your brush land so nearly worthless for all time. Then count the cost of grubbing and plowing, if indeed such land is susceptible to the plow. No man can afford to grub and plow brush land in this day and age of the world any more than he can afford to plant a large field of corn without a planter. In hilly or mountainous portions of the country the Angora goat can be made to do a great service in the way of clearing the underbrush, when the land will bring grass after the brush is gone. It would surely be a paying business to buy up large tracts of rough land in the mountain districts, or indeed any brush land in the United States, and clear the brush and set in grass. Afterward, if the owner liked other stock better, he might dispense with the Angoras. In many places where the country is too bare to furnish sheep with sufficient feed goats will do exceedingly well. In many places where leaves are abundant and there is scarcely any grass, making it impossible to profitably keep sheep, goats will do admirably well.

While Dr. Standley's experience is that goats will not to any appreciable extent peel the bark off shrubbery, the experience of others is quite the reverse.

Browsing supplements feeding.—The browsing habits of goats is important in connection with the question of feeding. In some places they obtain enough browse to carry them through the winter. This is especially true of the Southwest, where there is so great an abundance of live oak. If snow is on the ground, or for other reasons the goats are deprived of opportunities for foraging, the trees are cut down for them. They pass through the winter in good condition with other feed. Wherever they are deprived of opportunities for browsing, they must be fed. Browsing saves feed. As far north as Nevada Mr. Bailey's goats subsist the winter through on sagebrush.

Browsing adds some flavor.—It is noted that many of the correspondents heretofore quoted state that it is the browsing of the Angora that gives to the meat the game flavor, thus leading some to name the meat "Angora venison." It is also stated that when deprived of browse and fed on grass and grain the game flavor disappears. There is no reason why this should not be true, for it is a well-known fact that flavor may not only be fed into meat, but into milk and eggs as well.

Common goats as brush destroyers.—The fact must not be overlooked that the brush-destroying habit is common to all kinds of goats. The common goats will do the work as well as the Angoras. The latter are employed for the purpose because they are more plentiful and because there is profit in their progeny for breeding purposes, their mohair, and their meat.

Preserving brush land for browsing.—Up to this point consideration has been given to these goats as a means of clearing land for pasture or for cultivation. There is much brush land in the United States which will support goats but is good for nothing else. If this is to be devoted to goat raising, it is, of course, not desirable that the brush be entirely exterminated. In this event a goat raiser should have several fenced areas and change the goats from one to the other frequently. They should not be permitted entirely to denude one field before they are transferred to another. It is true, however, that no matter how perfectly a woodland may be cleared of brush it will be covered over again with briers and brush in a few years if constant attention is not given it. It is not difficult to overpasture such land, and if the goats adopt the "peeling" practice the brush and trees will have greater difficulty in recovering.

Grass and weeds as pasturage.—Considerable interest has been manifested in the Angora industry in those localities where browse is not available and where grass and weeds form the only pasturage. A great many inquiries of this character have come to the Bureau, and the Bureau, in turn, has referred the matter to the breeders of the country. The replies received have been numerous, and show a difference of opinion. The predominant opinion, however, seems to be that the goats thrive best under the conditions most nearly like those of their original home. It is certainly the best argument to say that goats prefer any kind of browse to the most nutritious of grasses, which is true, and therefore browse is better for them than grass. While the more economical conditions obtain where there is an abundance of browse, it is not definitely settled that the goats will not thrive well on common pasture grasses. It is the opinion of the writer that this question is still an open one, as some successful breeders have had goats on the grass range for thirty years. From the standpoint of the goat's preference, there is no question that browse is the better food, and this in itself is a forceful argument.

There is always expense in connection with pasture grasses, but there is little or none with browse. One of the chief reasons why goats are receiving so much consideration at this time is that they are practically inexpensive feeders, and so all items of expense must be figured on if profit is to result. Pasturage, unlike browse, is not available all the year through. Therefore in prairie locations feeding in winter is a necessity. One of the recommendations in favor of Angora mutton is that it has the flavor of venison. This flavor is imparted by the browse, and is absent in the mutton made from grass or grain feed. Many claim that the animals make a better growth among the bushes than on open pastures, and that the quality of the fleece is much better. Contrary to this, however, is the opinion of Mr. Philo Ogden, of California, who says: "The fact is that the brush disappears from my range and the fleeces become heavier, with less wax or gum, and have more luster. Further, 75 per cent of the young stock are larger than their parents and shear more and finer hair." He says, also, that his experience in raising Jersey cattle was similar, in the respect that as they were taken out of brush pasturage and grown on grass pasturage they obtained a larger frame, so much so that sales failed because of a suspicion that they were not purebred.

Pasturing with other stock.—So far as the goats themselves are concerned, they may be kept in the pastures where there are sheep, cattle, and horses. Their presence is in no way obnoxious to any of these animals. It has already been pointed out that a few of them in a flock of sheep are a protection against dogs. However, it is not best for the goats that they be kept in pastures with horses. This is especially important if there are kids, as the horses have a habit of playfully chasing any animal that is not large enough to defend itself, and they are apt to strike the kids. It is also important that the kids should not be in pasture with hogs, which are liable to eat them.

Number of goats to an acre.—This is a question frequently asked, but certainly no thoughtful person expects a definite answer. The number will depend, first, upon the object in pasturing on brush land, whether it is to kill the brush or to use it as a permanent pasture; and second, upon the quantity of feed obtainable. While one acre might be as dense as a jungle, another might have small thickets alternating with grass plats. Thus it will be seen that a definite answer can not be given to this question.

Mohair.

Quality of the fiber.—The word "mohair" is the technical name for the fiber of the Angora goat which is used in the manufacture of fabrics. The word comes to us, through the old French "mohere," from the Arabic "mukhayyar," meaning mohair cloth.

Besides the mohair there grows upon the Angora goat a short, stiff hair, which is technically known as "kemp"—a subject that will be discussed in another paragraph. It is held by some writers that this short hair does not occur on the pure Angora, and that where it does appear it is upon Angoras that have been bred up by crossing upon the common goats; in short, that it is a relic of the common goat. This argument seems plausible, at least, for two reasons: First, there is no certainty that any Angora goats now in existence are absolutely purebred, as many years ago the Turkish breeders began the practice of crossing upon the Kurd goats, and thus vitiating the blood; second, it is noticeable in building up a flock by crossing upon the common goats that the short hair is very prominent in the first cross, and gradually grows less as the crosses become higher.

The uses of mohair in manufactures are discussed hereafter and need not be repeated here. The properties of this fiber which render it desirable are length, fineness, luster, strength, elasticity, and specific gravity, and these are relatively desirable in about the order given. There is no difficulty in securing length and strength, but the other properties must come by the most painstaking care by breeding. Having length, strength, and luster, the manufacturer wants the fiber as fine as can be bred. Good mohair averages about one five-thousandth of an inch in diameter; or, expressed otherwise, 5,000 hairs may be laid side by side in solid contact within the space of 1 inch.

Many mohair growers assert that the quality of the fiber depends largely upon the climate and the feed; and all are agreed that the fiber becomes coarser as the animal grows older. Schreiner says:

If goats are to produce the best fleeces they are capable of, they must be maintained in uninterrupted good condition. They must have a variety of food, principally shrubs and aromatic plants, and lead an active life; they must, if possible, have running water to drink and be kept free from dust; they must not be kraaled (or shedded) except when absolutely necessary; they must have clean sleeping places and must not be crowded together.

The wide range of prices of mohair in the market is due to various causes, but to none so much as the unevenness in quality of fibers. As compared to the total production in the United States, the quantity of first-class mohair is exceedingly small. The tendency has been to breed for length of fleece and size of animal. While both these qualities are desirable, it ought to be plain to anyone that profit does not lie in these directions wholly.

Mohair in a general sense is an expansive term, covering the fleeces of goats of various Angora crosses. The fleece from a cross between an Angora buck and the common "nannie," although scant, coarse, and of uneven length, is unfortunately called mohair, just the same as that from the best animal. The fleece of the second cross is better, and that of the fourth and fifth crosses very good, provided, always, that first-class bucks have been used. The complaint of the manufacturers is that very little first-class mohair is produced in the United States. It has been demonstrated, however, that a first-class fiber can be produced here. Mr. Meeker, late consul at Bradford, England, the leading mohair market of the world, recently wrote as follows:

There has been on exhibition at this consulate for the past week an American-grown mohair fleece forwarded to Bradford by Mr. C. P. Bailey, of San Jose, Cal. The fleece is that of a 2-year-old graded doe and is understood to have been grown on Mr. Bailey's ranch in Nevada. The quality of the hair has been the wonder of all who have seen it. It has been closely examined by several of the leading mohair dealers and importers, all of whom have expressed the highest opinion of it. One of them, Jonas Whitley, ex-mayor of Bradford, said: "I have now in my warehouse about $200,000 worth of mohair both Turkey and Cape, and I am entirely sincere when I state that there is not a better fleece in the lot. I will buy all the American mohair like that that may be offered me at the market price. Should it uniformly equal this fleece, I do not know but what I would pay more than the market price. . . . I unhesitatingly say that the sample fleece is as good mohair as is grown."

A well-known spinner of New England is quoted by Mr. Bailey as saying that—

The American mohair is better than any brought from abroad; it is smoother, makes a smoother thread, and runs spindles faster; it is silkier and softer, and I can pick out cloth from it without looking.

Mr. G. A. Hoerle says:

Samples of our best mohair which were sent to England were classed as equal to the best Turkish, while the best Cape hair was as much as 2 or 3 cents lower, a fact which proves that even if we finally should have to ship mohair to Europe it would, in the long run, pay as well as selling at home.

Those American breeders who have been taught to believe that the mohair of the Cape of Good Hope is so much better than that produced here will find encouragement in the following from Mr. S. B. Hollings, writing to The Midland News, Bradford, England, under date of April 27, 1900:

When I state that the vast majority of mohair clips produced in Cape Colony does not fill the bill of our manufacturers I state the whole and sole reason why Turkish sorts have been called upon very extensively in preference to that grown in South Africa. . . . I am stating a plain fact that Bradford users do not think that the Cape clip is as yet within 25 per cent of the general excellence of that grown in Asia Minor, and that much remains to be done before users here will avail themselves of that produced in Cape Colony in preference to that grown in Turkey.

The encouragement is not in the fact that the Cape mohair is so much poorer than the Turkish product, but because ours is no worse than that of the Cape. Although the annual product of the Cape of Good Hope is about 12,000,000 pounds and ours only 1,000,000 pounds approximately, the growers there recognize the importance of the American industry. Mr. W. Hammond Tooke, after discussing the Australian possibilities in this industry, says "the United States of America should give us more concern." In the same article published in The Agricultural Journal of the Cape (May 25, 1899), he states that the breeding of goats here for mohair is no longer considered an experiment, and that the mohair is "much like a large part of that produced in the Cape, consisting of rather low grades, short and crossbred, and only suitable for combination yarns and for mixing with Turkey hair."

Influence of age and blood on fiber.—Reference has already been made to the fact that the fiber becomes coarser as the animal grows older. The fiber is also coarse upon younger animals of the lower crosses. The best fiber grows upon the animals of best blood; and among these that upon kids, yearling wethers, and does, in the order named, is preferred. The best fiber is usually very curly, in ringlets rather, but not kinky. It loses its curl and becomes thinner on the goat, coarser, and straighter as the animal grows older. A fiber of best quality is shown on the left of the cut. It will be noticed by careful examination of this illustration that the samples become less curly as arranged from left to right. The reason for this is that the samples are coarser toward the right. The last sample in the illustration is from an old buck, the one next to it from an old doe, while the two samples on the left are from kids.

(To be continued.)

THE SPRUCE GUM HARVEST.

In order to be fragrant and agreeable to those who chew it, spruce gum must be ripened under certain climatic conditions that are best realized in Northern Maine. While good, clear gum is often found growing spontaneously in the wild woods without the help of human agencies, the best spruce gum—the kind that sells at $1 a pound wholesale—is the direct result of the gum gatherer's foresight. Gum is the dried and crystallized sap of the spruce tree, which has exuded and simmered in the heat of summer's sun, and then hardened into amberlike nuggets in the cold of a long winter.

Maple sugar may be made by boiling the sap of the rock maple tree for a few hours, but if a man were to try to produce spruce gum by boiling the sap of the spruce tree he would get nothing except a bitter and sticky tar.

Of the fifteen thousand pounds of spruce gum annually harvested in Maine, twelve thousand pounds or more are gathered in the month of March. The gum picker wears steel climbing spurs on his boots, and in his belt he carries a light hatchet, while strapped to his waist is a bag with a wide mouth for the reception of the gum. Climbing a tree, the picker proceeds from limb to limb, chipping off the lumps of gum as he finds them, until he reaches the top. Most of the gum is caught in the wide open bag as it falls from the tree, while all that goes to the ground stands out in such relief upon the snow that it is easily picked up. Having picked all the gum on the tree, the picker hacks and scars the bark, so that the tree may produce another crop.

The best tasting and cleanest gum comes from the deep and narrow cuts made on the south side of a tree. Wounds made on the north side may exude sap, but, being away from the sun, the sticky juices are filled with spills and bits of bark before they have time to crystallize. By scoring the bark in March the early flow of sap is made to come out slowly, and it forms a dam of pitch, so that when the heat of summer comes on and the sap runs freely, the gum hangs in pendulous bags, which are glued to the bark in the matrix which formed as soon as the scar was made.

Weather conditions have as much to do with the making of good gum as in the making of good hay. When the first drop of crystal gum has exuded and hardened it grows daily in layers from the outside.

When there is a succession of warm and windless days, followed by cool nights, the overlapping coats of pitch will harden up as pure gum. A windy or a cloudy day, followed by a hot night, leaves the gum soft on the surface; then, when a dead spill or an insect lights upon the globule it becomes glued to the spot and remains there, a permanent blemish to the gum.

Spruce sap ceases to flow after July 15. From that time on, until the picker comes in March, the bags or globules of pitch harden and sweeten, until they turn to flinty lumps of fragrance.

In May and June the gum drops have a warty appearance; they are yellow and viscid, and have a disagreeably pungent taste, much like that of turpentine. A month later the drops are hardened on the surface, and the yellow color has given place to an amberlike transparency. The masses are still sticky inside, and the turpentine taste has been succeeded by an intense bitterness. Under the suns of August the crystals of gum show pink and amber tints on the surface, and have a vitreous luster when broken open. Most of the sticky center has hardened, but the pungent taste remains.

In September and October the pink line grows deeper, and is streaked with browns; by December every particle of pitch has become hardened, while from New Year's Day to March the frosts and ice take out the bitter taste and leave in its place that matchless aroma which gum chewers prize. Then the gum picker has his harvest time.

THE OREGON HOP INDUSTRY.

By JOSEPH A. HILL.

FOR many years hops have been cultivated extensively in Oregon. She has not only supplied her own demands, but also shipped them to the Eastern States and even to Europe. So great has this exporting been that they are recognized almost everywhere all over the world. But, however, for the last five or six years the price and demand for hops have been so low that many hundreds of growers have been compelled to plow up their yards. The methods of raising have been brought down to a very fine point, since more care and time have to be spent on them than on almost any other crop.

Hops are not generally raised from seed, as one year is lost, since they do not mature until the third year. However, as the first year's growth from roots does not give forth a crop, generally something else is raised, instead of leaving the field idle, which is very possible as the vines are eight feet apart and in straight rows. In a great many places potatoes were planted, but afterward they proved very harmful, for the hops were poisoned by them, so corn has been used instead. Great care has to be taken that the young vines are not broken or injured, as they bleed badly and often die. Again in a great many cases shoots do not come forth, in these places new plants have to be supplied the following fall. When the false crop, if you may so call it, that between the rows, has been gathered, all the vines have to be cut leaving very short stubs on the surface and at the same time small sticks are left to mark the places of the roots. Then the dead vines are raked up and burned.

In the very early spring, when the first sprouts come forth and reach about the height of six inches, then is begun the cultivation, which consists of plowing several times, first in the direction of one row and then at right angles. Harrowing is taken up and continued until the soil becomes perfectly smooth and even. By this time the young vine has sent forth many branches. The first shoots vary from five to ten in number, of these generally only four are saved. After all the shoots have been cut away the branches have to be nipped off, and this must be done very carefully as the vine may bleed and cause much trouble. When all the shoots have been cut and all the branches and creepers have been nipped, the young vines must be tied to poles by strings or wires, with which every yard is supplied. Sometimes, however, the yard has to be gone over a second time to be certain that all have started to climb their respective supports. Now the hops could be left alone until ripe if there were no lice to bother them.

The farmers and growers have been troubled for the last few years with hop lice. These little pests came over from Germany, it is believed, but how and when nobody knows. Some fly and others do not. They are a very peculiar insect and have many peculiar habits. However, I will not discuss these, but only show the harm rendered by them. They are found on the vine in the very early spring; it seems as if they come from the roots. Then when the bur of the hop forms they crawl inside to die, and decaying cause the hop to turn black, and mold setting in, renders them useless. There is only one way of stopping them and that is by spraying the vine just as the bur begins to be formed. Quite a strong solution is used and soap is also added to hold the substance on to the leaves. But in spite of all your pains they will get inside—it takes at least ten or twelve to do much damage. Then again, if the foliage is very heavy it is exceedingly hard and almost impossible to reach them. They also eat the leaves, which turn brown and then drop into the pickings and cause dirty hops. These sprayings are repeated several times and are very expensive, but after the bur becomes full grown spraying is useless, but if the season is hot and dry there will be few lice, as they can stand no heat.

When the hop has matured it turns yellow and then the picking begins, which is mostly done by women and children, while in many places Chinese and Japanese are employed and in some parts of Washington, Indians. Picking is done in two ways, either by the box or by the pound; a box holds nine bushels, and for filling this the picker receives from twenty-five to forty cents; the latter method, however, is not a very honest device as will be shown later. The hops are picked into baskets, sacks and hoppers, the latter are the most extensively used and similar to a large stretcher with a deep concave hole in the middle covered with burlap; these when full hold about three boxes. The hops hang in large bunches like grapes, and are stripped off by means of the thumb and first finger. Small leaves make little or no difference; but large ones and long stems must be kept out if possible. When these hoppers are full they are carried to a station where they are measured and tickets given for the number of boxes. But in the case where they are weighed it is done differently, the hops are generally picked in baskets and then poured into sacks by the pickers themselves. These are not carried to a station, but a wagon with scales makes a round at intervals and collects and pays for the number of pounds. Sometimes the grower lightens his scales and in return the pickers put stones and mud into the hops to make them heavier. Here it is plainly seen both are cheating each other, and almost always the pickers get the best of it, since they care nothing about the grade of the hop. About fifty to fifty-two pounds is the weight of a nine-bushel box. After picking they are taken to the hop kiln or drier to be dried or cured.

The hop kiln is a building of two stories with a ventilator at the top and bottom, in order to give a good draught. On the first floor are the stoves, generally two in number, depending on the size of the house. To these are attached long stove-pipes to distribute the heat evenly, and the walls are covered with sheet-iron or calsomined to prevent fire. The second story is of a rough finish. The floor is made of strips one inch square, and at the distance of one inch apart, this is covered with heavy burlap. Upon this are laid the hops, and a heat of 160 deg. is kept up for twenty-four hours. For twelve hours of this time sulphur is burned on the first floor, this being done to give the hops a rich color. After the drying has been completed they are allowed to chill for six hours, then shoveled into the store house to be baled. The baling of hops is similar to cotton, they average about two hundred pounds. They are kept in this form until sold.

About 1895 the demand for hops was so small and the price so low that the amount raised greatly decreased. But in 1899 an association was formed to protect the growers, nearly all of whom joined. The object in view was to buy up all the hops of the poorer growers and hold them until the price was raised and then pay the increase of price to the farmers. It can be plainly seen that the association controlled all the hops of the State, and they would not sell until a good price was offered. In the first year of the association the price for Oregon hops doubled itself.

The outlook for the industry in Oregon is very bright at present, and if it continues so will be directly beneficial both to the grower and to the State.—Yale Scientific Monthly.

SAVING STONEHENGE.

PLANS FOR RESTORING AND PRESERVING THE UNIQUE REMAINS.

EVERYBODY who has time to take even a mild interest in our past will be glad to learn from Lord Edmond Fitzmaurice that definite steps are at last being taken to insure the preservation of Stonehenge, says The London News. Sir Thomas Browne, who was too amiable a man to have any conception of the vandalism that exists in the world, did not foresee the need of any particular precautions to this end. "These mountainous monuments," he observed, "may stand, and are like to have the same period with the earth." But the last two or three centuries have done more damage to our finest megalithic monuments than perhaps all the ages since they were built by a strange and forgotten race. The glorious temple of Avebury, once the finest thing of the kind in the whole of Europe, has suffered most of all. Some archæologists—the lucky people, as the Syracusan lady says in Theocritus, to know all that!—are of opinion that Hecatæus referred to Avebury when he went into classical raptures about the magnificent circular temple that stood in the Island of the Hyperboreans, over against Celtica.

It is certain that old Aubrey thought that Avebury, in its fair and unpolluted days, "did as much exceed Stonehenge as a cathedral does a parish church." Now it has all but perished. Out of 650 great stones that once formed its circles, not more than twenty are standing. Lord Avebury, who very appropriately took his title from the ruin that he did more than any other Englishman of our days to illustrate, mourns that "unfortunately for us, the pretty little village of Avebury, like some beautiful parasite, has grown up at the expense and in the midst of the ancient temple." It is a natural tendency of the uncultivated human mind to utilize the relics of even a prehistoric past as the quarry for modern castles or pigsties. The medieval Romans happened to build castles out of the Coliseum, and one is less angry with them, perhaps, than with the Wiltshire farmers who turned so much of Avebury into cottages and pigsties. After all, we can pride ourselves on never having done anything quite so bad as the Roman builders who fed their limekilns with the sculptured spoils of Greece. We may be an inartistic race, but for thorough vandalism we have to look to Italy, the home and stepmother of the fine arts. One cannot be so very angry with the Wiltshire farmers who used to send a cart to Stonehenge, as Aubrey and Stukely tell us, when they needed stone for their bridges or mill dams. But the time has come to stop that kind of enterprise for ever. The Wilts County Council, through the mouth of Lord Edmond Fitzmaurice, announces that they are in communication with the owner of Stonehenge and with the Society of Antiquaries, and propose to put forward suggestions as to the restoration, future custody, and preservation of that megalithic monument.

We hope that the public will have an opportunity of considering the ultimate decision in this important matter. As they will probably be asked to contribute to its cost, that may be taken for granted. We have rather a terror of "restoration," thanks to Mr. Ruskin's energetic exposure of the crimes that have been committed in its name on some of the finest of ancient churches, and it is restoration as well as safe keeping that some demand for Stonehenge. There is no longer any fear of the whole thing being shipped off bodily to America, as we believe a wealthy dealer in curiosities once proposed; our own dealings with the Elgin Marbles and Cleopatra's Needle left us little right to affect indignation at this, but it would not be allowed. Nor is there much fear of the tourist who loves to carve his name in the most inappropriate places or to remove specimens of remarkable monuments. "The stone is so exceedingly hard," wrote John Evelyn, who tried it, "that all my strength with a hammer could not break a fragment; which hardness I attribute to their so long exposure." Only a determined quarryman can do any deliberate damage, and he is warned off for all time. But there is the weather to reckon with. The fall of stones at the end of the last century—nearly coinciding with the centenary of the previous fall, which local Tories attributed to some occult sympathy with the excesses of the French Revolution—suggested that it might be needful to take steps for saving the remaining stones, if not to re-erect those that were already prostrate. On the latter point we are convinced that any such attempt would be as gross an error as those into which the so-called restorers of churches have so often fallen. Inigo Jones thought of restoring Stonehenge to its original plan, and we are all thankful that he abandoned the idea. Posterity might not think any better of our antiquarian knowledge than we do of his. Flinders Petrie, who has sent home from Egypt the most interesting contribution that has yet been made to the discussion, says with great justice that "to trim up the place, by re-erecting every stone that has fallen, would be no benefit either to its appearance or to archæology. . . . The real effort should be to save those now gradually yielding over, especially the largest stone of all." Surely resources of modern science are quite adequate to preserve Stonehenge, exactly as it is now, for the next twenty centuries; otherwise, when we think of our nameless ancestors who swung these blocks of sixty or seventy tons apiece into place, with merely their primitive muscles and a few bronze tools and hide ropes to help them, we could hardly feel the proper pride in man's advance through the ages.

Flinders Petrie, who speaks with the highest authority on any question of archæological excavation, and has done more work than any other living man in Stonehenge itself, points out that the process of bedding the stones in concrete so as to give them a firm hold for the next twenty centuries would afford an unprecedented opportunity of settling the long vexed questions as to the date and object of Stonehenge. At present we cannot say that we have greatly advanced on the remark which our dear Samuel Pepys, with his usual good sense, made when he visited the prodigious stones more than two hundred years ago, "God knows what their use was! They are hard to tell, but yet may be told." At present we can only say of the best theory of Stonehenge that it is a probable conjecture, which might be definitely confirmed by such excavations as the process of bedding the stones in concrete would involve. This, of course, is Lord Avebury's theory, that the stones date from the Bronze Age—when man had ceased to live upon oysters and foes, and was on the high road to civilization and respectability—and that they formed at once a temple and a place of burial. Any one who is not satisfied with this modest supposition has only to pay his money for the books on the subject, and take his choice of more pretentious accounts. Stonehenge has been variously attributed to the Phœnicians, the Belgæ, the Romans, the Druids, the Saxons and the Danes. It has been called a temple of the sun, and of serpent worship, a shrine of Buddha, a planetarian, a gigantic gallows on which defeated British leaders were solemnly hung in honor of Woden—this use might be revived with advantage to the War Office—a Gilgal where the army met and leaders were buried, and a perpetual calendar. One theorist calls in Hengist, that noble Dane, and another thinks that Merlin and his "art magic" had something to do with it. These things are not so probable as Lord Avebury's theory; they partake rather of the nature of what the Regent Moray called "a devout imagination."

TOMATOES AND CANTALOUPES IN EUROPE.

VICE-CONSUL HANAUER, at Frankfort, says: "English statistics show that of late there has been a large and rapidly growing importation of tomatoes, the Canary Islands furnishing the supply, which importation amounted to 16,389 tons during the first half of this year. The wholesale price of this quantity was £331,302 (about $1,655,000). Tomatoes were but a short time ago an article of luxury in Great Britain, only used for the pampered palates of the rich; but now they have become a common dish on the table of the working classes. In Germany fresh tomatoes are sold at high prices (6 to 14 cents a pound, according to season); they are chiefly used to flavor meats, not stewed. Only the best hotels and the wealthy buy fresh tomatoes, which are supplied to Germany mainly by Southern France. Canned tomato pulp is to be found at the grocers' of large German cities, offered at a lower price, comparatively, than the fresh fruit.

"Cantaloupes are a great delicacy—even more than the pineapple—in German cities. They sell at 2 to 6 marks (50 cents to $1.50) apiece, weighing 3 to 10 pounds. Some of these are brought from Spain; others are raised in German hothouses. Considering that tomatoes have been sold as low as $5 a ton in Delaware and New Jersey and that fine cantaloupes can be bought in Philadelphia at 1 to 3 cents apiece, the question arises, Why don't we export fresh vegetables to Europe? The growers of our Atlantic States should form an export association, which—if it will send out men of mercantile ability who can speak German and French—would find the European continent, as well as England, an excellent market for their produce. No country could compete with us in the export of agricultural and industrial products were we to adopt the mercantile methods of European traders."

THE CALIFORNIA ORANGE CROP.

ESTIMATES of the California orange yield grow larger as the season advances. The estimate of all citrus fruits for 1901, in The San Francisco Chronicle Annual, was 22,000 carloads, of which 1,145 were set down for central California. The railroad authorities are said to now estimate the southern crop of oranges alone at between 19,000 and 20,000 carloads, of which, up to January 19, 4,400 carloads had been shipped,

which breaks all records to that date, while 850 carloads have gone forward from the central part of the State. Our contemporary's estimate of the shipments from the district of which Oroville is the center was 500 carloads, and the Southern Pacific Company now estimates the total crop from that district at between 900 and 1,000, which goes to show that new groves are coming into bearing of which no one knew anything. It is probable, as is usual in good years, that the citrus crop will exceed all estimates, and that this will be the most prosperous year California citrus-growers have ever known. The abundant rains which have fallen in the southern counties will improve the quality of the fruit and strengthen the vitality of the trees to produce next year's crop.

SNOW UPON RAILWAYS.

ALMOST every winter the running of trains upon our railways is interfered with by the accumulation of snow upon the tracks. But in France such accidents are not very frequent, and occur as a general thing only upon the lines of the mountain regions, and, in most cases, occasion delays of but a few hours. In other countries, on the contrary, snow would every winter regularly and completely paralyze traffic upon railways were not precautions taken against the obstruction produced by it.

In no country does the struggle against snow present as many difficulties as in Russia, not only because of the severity of the winters and frequent storms there, but also by reason of the circumstance that the majority of the Russian railways pass through exposed districts badly defended by nature against drifts. So, in this country, as we learn from Engineer Serge de Kareisha, arrangements of a nature to annul or lessen the prejudicial effects of snow are now made at the time that the direction line of a new road is laid out. Nevertheless, despite all the precautions taken, it is not always possible to conquer this redoubtable adversary. The snow storms are sometimes so sudden and violent that they destroy all calculations. In a few instants the rails disappear under a thick stratum of snow, the cuttings are filled in, the trains are stalled, and it becomes necessary, with a large force of men and the use of special apparatus, to dig a deep trench in the snow in order to clear the track and re-establish traffic.

Prof. Wesseloffsky, in his work on "Climate of Russia," gives us some idea as to the violence of the snow storms that occur on the steppes of that country. It is difficult, says he, to imagine to what point man, and even animals, which usually possess a sense of orientation, lose this faculty during the violent "bourans" (vortices of snow formed by wind). Men freeze at a distance of a few feet from their dwellings and sometimes even in the streets of towns and villages. Cattle take flight before the wind, run for nearly a mile without stopping, and fall over precipices and perish.

The methods employed for removing the accumulation of snow from railways are of two kinds—preventive measures and digging processes. The first comprise the provisional or permanent installation of snow fenders, of protective lines of shrubs and of protections against avalanches. The second consist in the use of snow plows of different kinds, and are sometimes employed concurrently with the first; but, as a general thing, the snow fenders are reserved for the permanent protection of tracks exposed to encumberment every winter, and the snow plows to the clearing away of accidental accumulations. We shall now see how the two methods are used, not only upon the railways of Russia, but also those of other countries particularly exposed to snow.

SNOW FENDERS.

In order to determine the site and most proper form of snow fenders, it is necessary in the first place to study the manner in which the encumberments of snow are produced. Two elements concur in their formation—matter and power. The matter is snow, and the power is the wind.

When the snow falls in calm weather it deposits upon the earth in a uniform and light layer and produces no obstruction; but snow driven by the wind, on the contrary, produces one, for the following reason: Every sudden change in the configuration of the earth (ditch, trench, etc.) constitutes an obstacle to the free course of the wind, which slackens or deflects the current of air in producing a calm. The flakes of snow carried along by the wind that chances to meet this tranquil zone lose their velocity, fall to the ground by reason of their weight and become the origin of an accumulation, the form of which depends upon the power and direction of the wind.

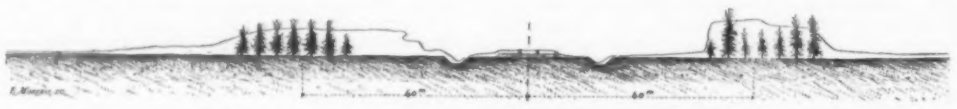
It is by reason of such a phenomenon that, during snow storms, light fences (of laths or trelliswork, for example) placed upon even ground cause on the side opposite the wind, owing to the shelter that they afford, an accumulation that takes the form of a wave, of which the crest is curved into a volute, like that of ocean waves. The width of such waves reaches from 12 to 17 times its height. In front of the fence, that is to say, on the side whence the wind comes, there is deposited also a small cushion of snow, which upon increasing joins the wave opposite and finally becomes confused therewith and forms a rampart of snow in which the fence is soon completely buried. It is by arranging such fences along lines of railways at the desired places and in a direction as nearly at right angles with the prevailing winds as possible that are formed the protecting screens called movable snow fenders.

In the curved parts these are interrupted here and there, and are placed so that they can slide in order that they may always be efficient. It must be remarked also that the snow that they arrest forms a wide talus that extends principally in the space comprised between the snow fenders and the railway. They ought, consequently, to be arranged at a sufficient distance from the rails to prevent the snow from ever encroaching upon the track. Such distance varies from 65 to 165 feet.

The same principles are observed in the establishment of stationary snow fenders consisting of live hedges formed by planting conifers, birches or acacias. Our engravings show such protections as they appear in summer and also when they are buried under a huge rampart of snow that they have contributed toward forming in winter. Wooden rules about 6½ feet in height and divided into ten parts permit of judging of the height of the plants and the depth of the snow. These kinds of protections are much used in Russia, where they have given excellent results.

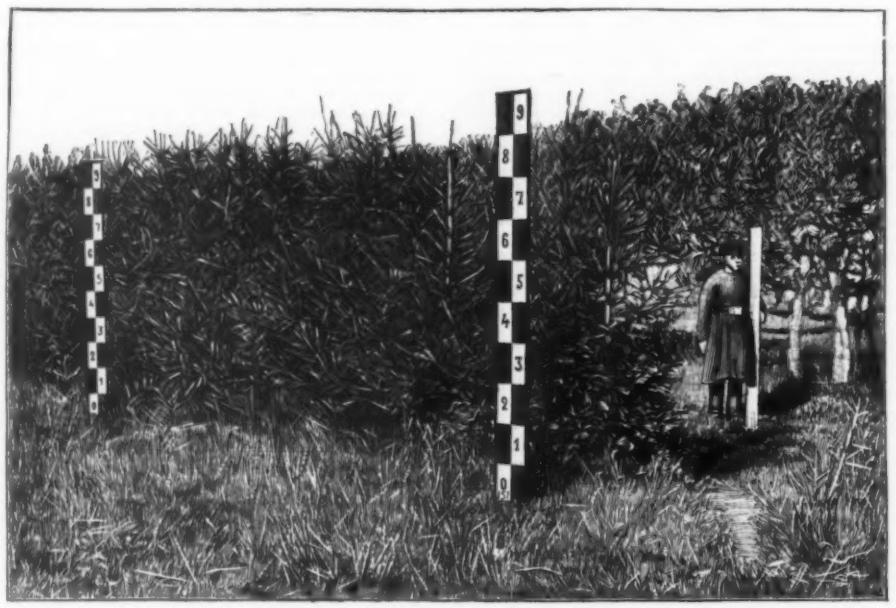
In mountainous countries the snow assumes another form that is particularly formidable, viz., that of avalanches. In order to preserve therefrom the railways that ascend the sides of deep valleys, and that are overhung by steep escarpments, there are installed, upon the threatened side, stationary snow fenders formed by rails or old ties. When the danger is greater wooden sheds or galleries are constructed over the track.

The largest examples of this kind of protection are met with in the United States at the approaches to the Rocky Mountains, and in Europe upon the Arlberg line.

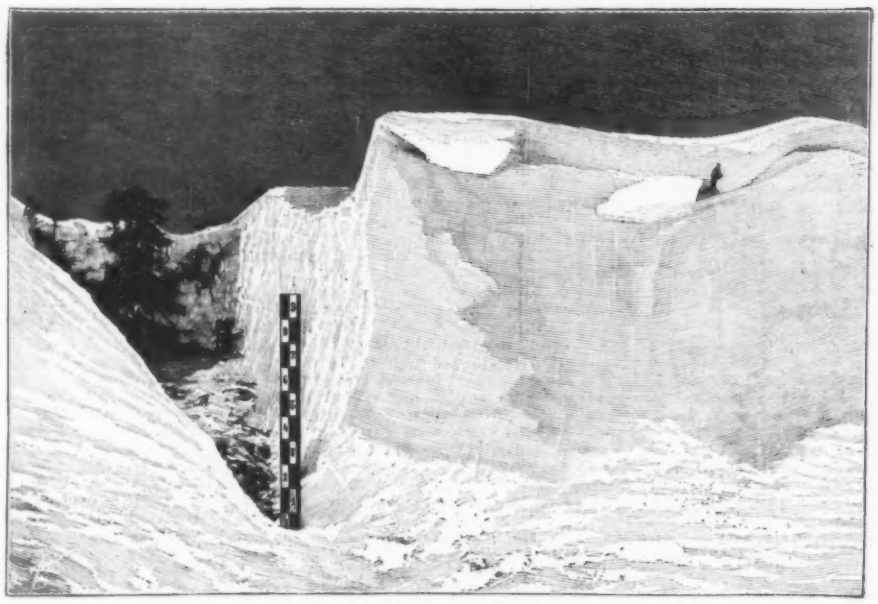


PROFILE ACROSS A RUSSIAN RAILWAY, SHOWING THE ARRANGEMENT OF PROTECTING PLANTS.

The upper sinuous line shows the limit of the taluses of snow fixed by the plants.



SNOW FENDER FORMED OF CONIFERS.



THE SAME BURIED UNDER AN ACCUMULATION OF SNOW.

SNOW PLOWS.

Finally, in almost all countries, when accidentally or despite the precautions taken, a railway becomes obstructed with snow it is cleared by means of shovels, or, better, by snow plows.

These apparatus, of very varied forms, may be referred to three principal types—small plows mounted in front of the locomotive, large plows carried by a special car, and rotary snow plows. The apparatus of the first two types enter the snow like the share of a plow or the ram of a war vessel. They are triangular in form and have lateral wings with helicoidal faces designed to throw to one side the mass of snow which they divide. These are the kinds most habitually employed upon the French railways. When their weight does not exceed from 1,300 to 1,800 pounds they are fixed to the front of the cowcatcher of the locomotive. They permit of easily clearing away a layer of snow of from 20 to 30 inches in thickness in running at a speed of 15 miles an hour.

Those of the largest size are carried by a special car shoved by a powerful locomotive. There are large snow plows of this kind upon the Austrian railways and upon the central system of the Compagnie d'Orleans. In the United States they have been improved by providing them with movable lateral wings which increase their useful effect; and their dimensions have been carried to extreme limits, as in the case of the eight-wheeler "Russel" type, which weighs 33 tons, and which is capable of making a 16-foot cutting and of throwing the snow to a distance of 33 feet on each side.

Whatever be the excavating power of the apparatus just mentioned they have the inconvenience of throwing the snow upon that which already exists upon each side of the track. If a new snow storm supervenes after their passage the banks thus formed cause obstacles still greater than those already overcome. It is therefore very necessary to shovel the snow as far away from the track as possible.

The American rotary machines perfectly fulfill this object, and at the same time perform the work with great power and rapidity. They are formidable machines, composed of a large car carrying in front a wheel provided with blades and set in motion by a steam engine in the car. While the apparatus, pushed by one or more locomotives, is burying itself in the mass of snow the wheel, which revolves 160 times a minute, cuts the snow by means of its blades, carries it along in its motion and throws it to a height of 50 feet, according to a parabolic trajectory and so that it shall fall on one side of the track at a distance of 130 feet.

Such machines are entering more and more into use in the United States, and are beginning to be used in

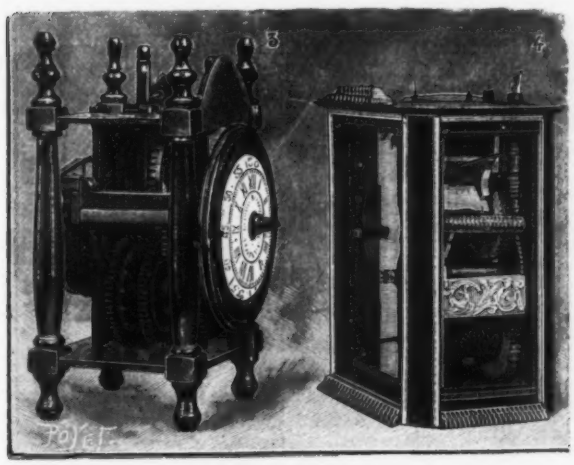
Europe upon the State railways of Hungary, Prussia and Russia.

There is one in the course of construction that will weigh 220,000 pounds and be actuated by a 700-horse power steam engine.—L'Illustration.

CARDBOARD, BOXWOOD AND IVORY CLOCKS.

IN the Centennial exhibits of the recent Exposition we found some very curious types of clocks, constructed of very strange materials. The clock shown in Fig. 1 was found in the Centennial of the Paper Trade, Class 91. It belongs to the rich collection of M. d'Allemagne. Its wheels, dial and pendulum are made of white cardboard. The five pillars that support the movement are of wood, painted white, as is also the cage in which the wheelwork is mounted. This cage consists of small cylindrical wooden rods, glued together. The movement consists of four wheels cut out of cardboard and fixed between two metallic ferrules mounted upon a steel spindle that carries a trundle or lantern pinion. The pivots of the wheels revolve in apertures formed in small plates of horn, mounted and glued upon the rods of the cage. Such combinations of friction of cardboard teeth upon iron pinions, and of iron pivots upon horn, were evidently happy, but the materials are very fragile.

FIGS. 1 AND 2.—EBONY AND BOXWOOD CLOCKS.



FIGS. 3 AND 4.—CARDBOARD AND IRON CLOCKS.

A bead of colored glass, mounted upon the pivot between the base plate and the piece of horn, reduces the friction and serves to regulate the play, but only for the two large wheels and upon one side. The escapement, which is most ingeniously arranged, is of large dimensions. It consists of a cardboard wheel that actuates an anchor of the same material having pallets made of horn. The slide balance is formed integrally with the anchor, and its suspension is of the most rudimentary character. It consists of a small frame of wooden rods, like the cage, resting through two points of iron upon a horizontal wooden support provided with two small metallic cups. The frame is so constructed that these points hold the balance and anchor in equilibrium so as to prevent any friction. The motor of the clock is very odd. The first wheel of the movement, as in clocks with weights wound up with a key, is provided with a drum, around which is wound a cord. But here the weight is replaced by a steel spiral spring, which, once tightened, exerts a traction upon the wheelwork and actuates it in the same manner as a weight would. This spring is mounted vertically and secured by one of its extremities to the base of the clock and by the other to the cord that winds around the first wheel of the movement. The manner in which tension is given to the spring is very curious. In the base we find a horizontal wooden drum that revolves with two steel pivots, one of which is prolonged to the exterior of the base. Here a small copper key is fixed in it. From this lower drum starts the cord that is to serve, through transmission, to tighten the spring, and that passes through an aperture in the base and ascends straight to the upper drum. To the center of this drum the two parts of the cord are attached through a small link. One part goes to the spring and the other to the drum at the base. When the spring is relaxed the cord that is to pull it is entirely unwound from the drum, while the part that descends to the base is, on the contrary, completely wound up; so that, in turning the small key fixed to the lower drum, the cord, upon unwinding, exerts a traction upon the upper drum and forces it to revolve, and consequently to wind up the cord attached to the spring and thus tighten it. This combination, which is somewhat complicated, is necessitated by the want of strength of the cage, in which it would be possible to mount only small horn plates for the reception of fine pivots. In order to wind up the upper drum directly with a key, it would have required an axis with a square of large size, which it would have been impossible to install.

It is said that such clocks ran pretty well, and for some little time. They were invented at Paris, about 1820, by M. Duclos, who named them "Cartorologes Invariables." Then they fell into desuetude, and are now very rare. However, it must be recognized that, independently of their want of strength, it is not through their decorative grace and their wan aspect that they recommend themselves as mantel ornaments. They were placed under a glass shade.

Boxwood Clock.—The clock shown in Fig. 2 was exhibited in the Centennial of Clockwork, Class 96. It belongs to our own collection. It is entirely of boxwood, except the dial, which is of enamel, and the pinions, which are of iron. It is marked "Lefebure, Horologer du Roy, à Fontainebleau." From this it will be seen that it was the work of a master, since the title, "Horologer du Roi," especially in a royal residence, possessed a real value. It dates back to the 18th century. In order to justify such a fancy, it was evidently necessary to maintain that wheels made of boxwood gave less friction than those made of metal. The fragility and difficulty of execution were readily forgotten. With time, the boxwood has assumed the color of old gold. The clock is provided with a striking train; but, unfortunately, the bell is now lacking. It probably was not of wood like the bell of Vendredi Saint.

Ebony and Ivory Clocks.—Fig. 3 represents a clock-work movement that was found in the same Centennial as the preceding. It now belongs to the Chambre Syndicale de l'Horlogerie, of Paris. The clockwork is of ivory, and the case of ebony and ivory. The piece, which dates from the beginning of the seventeenth century, is in a pretty bad state.

The fragility of the material explains the manifold restorations and repairs that it has had to undergo and that have finally ruined it. The workman who constructed it must have had to bestow much time and skill upon it. It is provided with a striking train. Ivory was in favor, except among certain clockmakers of the time, as a material that was resistant and prevented friction. In the German section was found a clock of the same epoch as the preceding. It was of wood and iron, but the teeth of the wheels were of ivory. Such tooth was set into the wood of the wheel.

Iron Clock.—The Centennial of Metallurgy, Class 62, exhibited a time piece of the fifteenth century that formed part of the sumptuous collection of M. Le Secq des Tournelles.

We found here the perfect type of the primitive clock entirely of iron. Strongly constructed, this clock, over which nearly five hundred years have passed without gravely injuring it, holds its age proudly, and its wheelwork might still furnish a service that those of which we have just spoken would now be incapable of performing.

In addition, it offers a great interest in that it shows us an undoubted specimen of the clock, with double vertical balance operating externally—the balance to which Huyghens applied the laws of Galileo's pendulum.

In it, we find the clock of the middle ages in all its splendor and the logic of its structure.—M. Planchon, in La Nature.

[Continued from SUPPLEMENT, No. 1316, page 21100.]

AMERICAN ENGINEERING PROGRESS.*

II. EDUCATIONAL INFLUENCES.

IT has been asked what are the American manufacturer's advantages over his British confrère, and to what these advantages are due? It is a bigger question than can be answered in a few words; but I will attempt to set down what appear to me to be the chief moving causes. Apart from physical resources—such as mineral wealth, etc., a subject already dealt with in former articles—perhaps the primary cause, if not the main-spring of American enterprise, is the consideration shown to youth. Mr. Lecky has said, in the introduction to "Democracy and Liberty:" "The respect for old age is one of the strongest of English instincts, and is often carried so far that it will be found that men only attain their maximum of influence at a time when their faculties are manifestly declining." The truth of this is strongly brought home to an Englishman on first visiting the United States. There one finds young men at the head of affairs everywhere. The great Carnegie steel works, which made a profit of between forty and forty-two million dollars in one year, afford an example; one among many. Those who meet the founder of the company see a man full of vitality, but who has retired from the active management of the business at an age when many in this country look forward to years of control. The acting president is a young man, who was apparently not much above thirty years of age when he was appointed. There are three principal steel works owned by the company, each controlled by superintendents equally young. In the whole course of my last trip to the United States, when I made the matter one of close observation, I can remember only two instances of elderly men taking the leading part in the management of works and in one of these the business, although of great reputation, did not give promise of further advancement.

The Americans go on the principle that youth is the season of energy. As a man advances in life he has less to hope; something has gone out of him. He ventures less and wins less. In this country we are over-cautious; and, though our caution may avoid some mistakes, it loses more good chances.

That the young men in the United States successfully fill positions for which we consider matured experience a first essential is due, no doubt, to a variety of causes, the first of which is to be found in the early treatment of children. I have sometimes been almost led to think there are no children in America, only some immature men and women. American children are mostly what we, or perhaps our mothers, would call "spoilt." But, however unpleasing—to strangers—this may appear, I am bound to say the system works well in the long run. The American child, being seldom checked, grows up without any feeling of restraint, and thus early becomes companionable. It is customary for fathers to discuss their business affairs with their sons in a way that is quite surprising to an Englishman. These apparently small causes have a far-reaching effect. The youth, when he leaves school or college and enters on his business career, has a feeling of well-sustained self-confidence that is more than half the equipment needful for the conduct of affairs. Probably the majority of successful administrators are actuated more by judgment than by precedent, and the man who lacks judgment at thirty is hardly likely to be successful—in virtue of precedent—at sixty.

The confidence the American business man thus extends to his youthful son is reflected in many ways that seem curious to an Englishman. A good many years ago I spent a few evenings with some students of one of the large American colleges. I was new to America then, and heard with surprise these college youths discussing questions that arose out of the businesses in which their fathers were engaged. If we compare this with what generally happens when lads of our own public schools or young men at our own universities meet together—when any mention of the paternal shop would be looked on as the worst of bad form—I think perhaps there will be seen one of the reasons why Americans are fitted to control

* London Times.

business at an earlier age than is usual in this country. "As the twig is bent, the tree's inclined."

The education hinted at above, the spontaneous education of social intercourse, is immeasurably above the mere learning of lessons, which too often goes by the name of education. I made many inquiries in America as to the value of technical education, and I am bound reluctantly to confess that, contrary to my anticipation, I did not find much evidence of its efficiency among many of those holding the more prominent positions as administrators. That, on consideration, is to be easily explained. It is a greater thing to be a moulder of men than of materials, and there has yet been no technical college for the development of the former gift.

Nevertheless—and it is necessary to say this, to prevent misconception—the technical colleges of all industrial nations in the present day are doing indispensable work. Any one now entering the engineering profession is severely handicapped if he has not had a technical education; that is to say, he should have a more complete knowledge of the scientific laws which govern physical phenomena than it was possible to acquire by the old system of apprenticeship and drawing office training only. The technical colleges are somewhat unfairly treated. A great many parents think that, because they have given their sons a three years' course, therefore they have insured to them a successful engineering career. That is unreasonable. No doubt a great many "wasters"—the well-understood engineer's term exactly expresses the condition—come from the technical schools, but then a great many wasters come from everywhere. Given two lads of approximately equal character, the technically educated will be sure to win in the long run. There is, however, less need to say much about technical education, as it has not a very important bearing on American competition, owing to equality of facilities in the two countries. In the United States there are some admirable technical schools; but, speaking from personal observation and not by the book, I should say we are as well off in England. That statement is open to correction by statistical data or more comprehensive knowledge on the part of others. At any rate, in England we have many splendidly equipped engineering laboratories for educational purposes and classes designed to give adequate instruction. To me it appears that the chief difference is in the young men themselves, and that is due to the previous home training, to which I have made reference.

Another reason for the adaptability of American youth to business is to be found in the schools. What we know as public schools in England are very different from the educational establishments which go by the same name in America. There, although there are wide differences, a public school might be likened to a superior board school, so conducted that the children of all, rich and poor, can attend. Thus one will find the son of a big manufacturing engineer on the same form as the children of the ordinary mechanics his father employs. The educational advantage to both is very great. The leveling that ensues is not leveling down, but leveling up. I am told there is no hostility between the two classes, but that their commingling acts as a restraint on the one from doing things that are unworthy, while the other endeavors to prove the equality it claims to be not undeserved. In Scotland we have somewhat similar conditions, though not so pronounced as in America.

The methods of teaching, too, appear to be different. So far as I can see, the American system is more truly educational, less pedagogic; the child is made to learn, I will not say things that are useful, but things that more develop his intelligence and reasoning faculties. I think any average Englishman of middle age, whether of a public or private school, who looks back on his school days must be struck by the vast amount of time and tears he spent in acquiring knowledge which he has entirely forgotten. "But the acquiring of this knowledge," it is said, "has developed his reasoning powers and strengthened his memory." The latter, no doubt, is true, and no one would undervalue memory. But the memory so acquired is of a description that is the least useful in the business affairs of life. Let us take a single example. Perhaps the most marvelous exhibition of memory is that displayed by players of blindfold chess; but who would select a man, because he was an expert in this science, to conduct a business? In regard to the claim of development of reasoning powers, it may be that the absolute reverse is the truth, and to learn by rote things that have no meaning to the learner is possibly the surest way to stunt the intellect. The most valuable intellectual gift a man can possess—I speak with all deference, not as an educationalist, but as an engineer—is the power of concentrating his mind on the problem immediately before him; and the learning of meaningless or objectless things—they need only be meaningless or objectless to the learner—is the surest way to cultivate a discursive mental habit. Let any one who doubts this watch the average schoolboy getting by rote a Greek verb or any other lesson equally empirical. The most trifling incident will distract his attention, and that not from willfulness, for the penalty of not knowing his lesson has many real terrors. Educational methods, I know, have improved and are still improving in this country, but when all is said I attribute the greater mental alertness of Americans, especially American middle-class youths, to the lead that American schools have taken in this respect.

We have now in England to most of our schools a "modern side" in which science is taught. It is a concession that has been wrung from headmasters and others by the dawning perception of parents that something more than the old methods are demanded. But concessions wrung with difficulty are apt to fail in the performance. Our educational system is in direct succession from the monastic foundations in which all learning was formerly concentrated, and the headmasters of to-day are mostly of the Church, as were the teachers of old. But what sufficed for education when commerce and manufacturing industry, as we know them, did not exist will not serve our turn to-day. It is a fact those who control education seem never quite to realize. As a consequence, where a "modern side" has been established in a school it is too often neglected and despised by the chief authorities, and the students are looked on as belonging to a class altogether inferior to those of the "classical side." There are exceptions, but a nation is not built up by exceptions.

It is necessary to say here that purely classical studies hold a prominent position in the curriculum of certain educational establishments of the United States. The principal of one of the most important of these informed me that he considered the dead languages might with advantage receive more attention than had hitherto been given to them. That referred to one of the most important and oldest of the universities of the country—a school with which some of the brightest and best names on the roll of the literary, artistic, and professional records of America are connected. What is put forward here, however, is advanced solely from the business standpoint, and I have founded my remarks on direct inquiries and personal observation, not on statistics and returns.

The character of its people makes or mars the destinies of a nation, and the characters of men and women are not moulded in a day. China possesses mineral riches probably as great as, perhaps greater than, those of the United States, but few would anticipate competition from unaided native Chinese engineering industry for half-a-dozen generations or more yet to come.

To me it appears one of the most disquieting factors in the problem before us that the United States have trained a body of young men who are determined to make their country great, and who have been educated to a living practical interest in the things needful to that end.

PRACTICAL FORESTRY IN THE ADIRONDACKS.

By B. E. FERNOW, Director N. Y. S. College of Forestry.

FOR thirty years and more we have talked upon the necessity of forest preservation while we have gone on as before merely exploiting our immense forest resources as if they would last forever, without assistance by man in their reproduction. During this talk, a good deal of sentimentality, misstatement and nonsense has crept into the arguments of those who saw danger ahead and sought means to avoid it; so much amateurish and crude conceptions regarding forestry have been spread about, that it has been a most difficult task for the better informed to correct these misconceptions and make the true nature of forestry apparent.

FORESTRY AN ART.

In its final analysis forestry is an art, and just as agriculture is the art of producing food crops and the business of making money from such production, so forestry is the art of producing wood crops and making money from them. There is one difference between these two productive arts, namely, that forest areas in certain locations may besides furnishing useful material exercise a potent influence upon general water conditions and hence the community, the public at large, and the State have an interest in the manner in which these protection forests are managed, greater than in farm lands. There is also one other striking difference between food crop and wood crop production, namely, that food crops cannot usually be produced without the aid of man, while wood crops are grown by nature without assistance. We find our supply forests grown by nature, we cut them down and nature reproduces them; what need is there, then, to apply skill and art in wood cropping?

IS FORESTRY NECESSARY?

We may admit that where forests cover the mountain slopes and thereby regulate the runoff of the rain and snow waters, influencing the river stages and preventing erosion and washing of soil, the cutting should be done with more care, avoiding wholesale clearing, but what is the need of forestry where no such protective function attaches to the forest? We answer frankly, none at all, unless business reasons compel us to it. As long as we can get our timber supplies from unassisted nature, there is no sense in applying skill and energy, which means money to produce them. And since forestry means skill and energy, hence money applied to wood production, the rational argument for its application must state the necessity for it.

This argument proceeds as follows: Nature is an uneconomical producer; it has plenty of time and space at its disposal and has no consideration of man's special wants. It grows weeds as readily, perhaps even more readily, than those plants which man considers useful; on an acre where 100,000 feet B. M. pine could be grown in 75 years, it grows perhaps 2,000 feet in 300 years, giving the balance up to weeds, albeit tree weeds, and to inferior tree forms, which do not furnish clear saw lumber, and this lavish use of time and space will be still more excessive if man by fire and ax interferes with nature's reproductive processes.

As long as we have large forest areas, in proportion to population and requirements for wood materials, we can perhaps afford to let nature take its slow and wasteful course, but when the relations of supply and demand become disproportionate it is time to see whether nature might not be profitably assisted to do better. This time, when requirements cannot any more be met by nature's unassisted efforts; when virgin supplies have been reduced beyond safe limits, and young growth does not any more replace annually what is annually consumed, this time, when the aid of man to direct reproduction is required, has, it is believed by many of us, arrived in the United States and some first beginnings of forestry practice have been made more or less systematically but mostly sporadically in various places.

The State of New York, owner of over 1,000,000 acres of mountain forest in the Adirondacks, has started upon a policy of buying up the culled areas in these mountains with a view of preserving them for their influences upon water flow and other indirect benefits to the people. It would be foolish and entirely unbusinesslike, however, to merely reserve this vast area of 3,000,000 acres or more, which finally is to be acquired, and tax the people for its maintenance and administration, if the property itself could without detriment pay for it. That this can be done, there can be no doubt, for it is done in other parts of the world, yet a demonstration of how it may be done under given conditions would be desirable.

A FORESTRY EXPERIMENT.

To secure such a demonstration Gov. Black conceived a novel plan. Fearing that if the attempt were left in the hands of political institutions it would lead to failure, he charged an educational institution, Cornell University, with carrying on the experiment. A tract of 30,000 acres of mountain forest was therefore placed at the disposal of the university, and a college of forestry was endowed, to be in charge of the tract and manage it according to forestry principles. Now, forestry principles can be briefly stated as implying the following: Harvesting old crops, replacing them by young, and, if possible, better kinds of crops, and doing it according to business principles in the cheapest, yet effective manner, making, if possible, a profit out of the old crop. There are then two kinds of problems to be solved, a silvicultural one, the growing of a new crop, and a commercial one, the profitable marketing of the old crop.

THE CONDITIONS.

The forest to be so managed is located in a rough mountain country, and is a hardwood forest of old birch, maple and beech; not the magnificent timber of North Carolina, but inferior in size, if not in quality, forest land from which the lumbermen have culled the white pine and spruce and leave them abandoned because, according to their ideas, the value is taken from it. A small amount of young spruce only remains, hardly fit for pulpwood. The proper silvicultural policy on such a property is to replace the hardwoods by the more valuable, more productive conifers, pine and spruce, mixed with hardwoods in smaller proportion. The financial policy is to do this as quickly as practicable, for the old hardwoods do not grow any more, as decay offsets annual growth. Rise in stumpage prices might make it appear financially best to delay cutting, but this consideration naturally was excluded in this experiment.

It might have been possible to secure lands from which the cream in the shape of pine and spruce had not yet been taken. Not only were prices for such lands too high, but the majority of the State holdings are of just this character of culled lands, and hence it was of most interest to find out how such denuded land could be handled. To make profits from such lands, it is necessary to market the hardwoods; and, indeed, in order to establish a new crop, the old hardwoods must be effectively removed in order to make room for the young crop. But no mills or other hardwood consumers were within reach, and hence a market had first to be created. Not only was it necessary to find a market for the logs, but much more so for the bulky cordwood and inferior material, which represents two to three times the volume of the logs.

PLACED ON BUSINESS BASIS.

The college management has been successful in securing such a market by inducing two manufacturers to combine in establishing plants in the neighborhood, one a stave and heading mill and the other a wood alcohol distillery, which together use up every stick of wood down to a 3-inch diameter. Hence, if a tree is felled every stick of wood in it is utilized. Thus one of the requirements of forestry is fulfilled, namely, thorough utilization, whatever is not fit for alcohol, even doty and half-rotten material, may still be used for brick and lime kilns, and an attempt is even made to utilize the brushwood, which is bundled and used for charcoal and otherwise. Such thorough utilization is, to be sure, possible only with railroad tracks built into the woods, and hence a broad gage road six miles in length at present has been built. Even so the profits on these minor materials will be small, or even negative, but to secure a good young crop and to avoid fire danger it is desirable to remove it, and burning has so far proved even more expensive than selling at a loss.

EXPERT FORESTRY METHODS.

The trees to be cut are marked by an expert forester and the felling is done with great care to reduce the amount of smashed young timber to a minimum. Such care, of course, costs! Especially the young spruce growth is to be saved and natural seeding from seed trees is to be encouraged—but as this young growth has often been killed out and seed trees are wanting artificial planting must be resorted to. For this purpose two nurseries have been established, in which especially white pine and Norway spruce are grown from seeds to be transplanted into the woods when two or three years old. In the first two years some hundred acres of burnt-over slash has been planted in pine, spruce and other conifers, and altogether some 2,000 acres of such burnt lands await such reforestation, besides whatever cut lands require it. It is expected that when the home nurseries are in good running order and furnish the plant material the cost per acre for such planting may be reduced to $5 or $6 per acre. Under present arrangements the entire hardwood crop, i. e., as much as it is proper under forest management to cut, is to be delivered to the manufacturers in fifteen annual installments. This involves, it is estimated, the yearly delivery of 2,500,000 feet of logs and 10,000 cords of wood, besides some 2,500 cords of lime-kiln wood and minor materials. As can be readily seen from these figures the experiment is carried on under commercial conditions and on a commercial basis and while financial aims were of secondary importance in the original conception of the plan, the attempt is made to render the experiment at least self-supporting.

FINANCES.

After a first appropriation of $30,000 to set up the institution and for preliminary work, survey, etc., which must be considered as additional investment,

hardly or only in part needed for private management, the legislature appropriated another $30,000, which it is the endeavor of the management to keep intact as working capital, relying upon the annual income from the sale of wood to carry on the experiment, management and replanting. This is the first year of the logging enterprise, and hence all figures are still in the realm of estimates, but unless the calculations are entirely erroneous it is expected that with the price of $6 per thousand and $2 per cord a balance of $10,000 will remain as income to be spent on replanting and other features of a forestry management. A crew of fifty men is busy getting out the logs and over one hundred wood choppers are engaged in making cordwood. Since the work in the woods must be done with much greater care than is usual in mere logging operations, and since an intelligent crew is needed to do the planting, it is the policy of the college to secure as far as possible a superior stable crew of men. This is done by improving the conditions of camp-life rather than by increased wages. A permanent model camp has been built, the men sleep on springs and mattresses instead of the customary straw and corduroy. They are fed in the best camp style, and whatever else can be done to make living comfortable is to be done.

In this way a better class of workmen is secured with very slight increase in expense.

IMPROVED FACILITIES.

The introduction of a steam skidder has been under contemplation, but it was thought best to postpone this innovation until profitable logging with the old method of relying on ice roads had been demonstrated, especially as the working fund was rather scantily measured. Here, then, for the first time, is a practical beginning of forestry on a commercial scale and on business principles practised in the Adirondacks. Whatever else has been attempted before in that direction has consisted in prescribing the diameter below which the logger is not allowed to cull the spruce; a wise restriction, no doubt, but hardly sufficient to insure the main object of forestry, namely, the reproduction of a superior young crop. With the old hardwood crop, defective and inactive, left on the ground, the reduction of the spruce admixture means only reduction of the chances of its reproduction and despoiling the future for the sake of the present. Every other forest property, to be sure, presenting different conditions within and without, would, of course, require a different solution of its problems.

MARKING OUT THE WAY.

The college can claim only to have pointed out the way, or one of several ways, of how to approach such a problem as was presented to it for solution. It can claim to have solved the first and most difficult part of the problem, namely, the commercial one; whether it will be successful with the silvicultural one only time can tell. While this experiment is to serve as a general object lesson and pave the way to a technical management of the forest reserve of the State, it also serves as a practice ground for the students of the college. During the spring term the students of the college meet with their professors in the college forest and participate as far as practicable in the practical forestry work. Five students passed from the college last year, all having found satisfactory employment either in government service or with lumbermen's concerns. At present twenty-four students are inscribed in the four years' courses, which it is the aim to make as thorough as any existing forestry school offers.

With the increasing number of professionally educated foresters, there can be no doubt that the application of the art must grow, and that every forest owner, alive to his interests, will soon find it profitable to utilize these men.—The Tradesman.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

United States Cheese in Brazil.—American dairies would, I think, do well to turn their attention to the possibility of exporting their cheese products to Brazil generally, and to Sao Paulo especially. The consumption of cheese in this State is very large. While it is not possible to give exact statistics, its use is much more universal than in the United States. In every family it is a staple food article, after coffee. Allowing a liberal margin for profit and for transportation, United States cheese could easily compete with the other foreign cheeses—mostly brought from Italy, Switzerland, and France—now controlling the Brazilian market. As to whether they could compete with the imitation cheeses more largely used by the working classes, and costing about 13 cents a pound, only the American producers can judge.

The wisest course would be for several dairy associations to send, in common, an expert to Brazil to carefully study not only prices, but the form and character of cheeses which the Brazilians desire.

A general agency should be established in Santos or Sao Paulo, in charge of an American able to speak and write the Portuguese language. The agent should then employ traveling men to visit the retail dealers in different parts of the Republic. Such a business campaign, intelligently carried out, could hardly fail to be exceedingly profitable to the American dairy trade.—John J. Girimondi, Consul at Santos.

Sulphur in Russia.—A large area of sulphur deposit has been recently discovered in the trans-Caspian territory of Siberia, which section, according to the article in a German periodical on which I base this report, is also rich in cotton, coal, and petroleum.

These new sulphur deposits, which can be considered among the most profitable on earth, are about 160 kilometers (100 miles) from the city Kwiva, and about 270 kilometers (168 miles) from the station Askhabad, on the Trans-Caspian Railroad; and cover an area of some 6,000 hectares (15,000 acres).

The sulphur forms about 60 per cent of the sandstone in which it occurs, in three little groups of hills northwest of the Ungus Valley, and according to present estimates amounts to about 9,000,000 tons.

The local conditions for obtaining this product are said to be so favorable that no shafts nor great quarrying will be required, although it will be necessary to build a narrow-gage railroad of 168 miles to Askhabad.

That this discovery is of the greatest value and importance is evident from the fact that Russia consumes annually about 20,000 tons of sulphur, and up to the time of this discovery has produced annually only about 1,000 tons.—E. Theophilus Liefeld, Consul at Freiberg.

Tourists' Postal Cards in Germany.—Consul Diederich of Bremen, under date of January 28, 1901, writes in regard to the popularity of tourists' postal cards in that country. There is no city nor hamlet, he says, no place of historical interest but has cards, embellished with some design appropriate to the locality, which offer convenient means of communication with friends at home. Last summer, according to post office returns, 20,808,313 cards were mailed in one week. Forty-six per cent were tourists' cards. The postage collected daily on these cards averaged about $15,845.33. Berlin furnished the largest quota—137,000 cards. Next followed Dresden, with 38,000; then Hamburg, Cologne, Leipzig, Breslau, Frankfort, Hanover, Halle, Düsseldorf, Wiesbaden, and Kiel. Bremen stood thirteenth on the list, with a daily average of 8,584 postals.

Peat Wood in Austria.—No natural product of the earth has been so much neglected and so little esteemed as peat; yet it contains a mine of wealth for those who can appreciate its possibilities. By its adaptability as material for fuel, it is of particular interest now, when the price of coal is so high in both hemispheres. It seems timely, therefore, to direct attention to this product, which exists in vast deposits throughout the temperate zone, and is present in especially large quantities all over North America, the beds ranging from 10 to 40 feet in depth, promising an available supply for many years to come. Although as yet peat cannot successfully compete as a fuel with anthracite coal, since in proportion to its heating value it is of great bulk, and hence makes transportation dearer; nevertheless, with the necessity of making practical use of it, invention cannot fail to be stimulated. The problem of so saturating and compressing it into bricks as to make it replace anthracite coal for household and industrial purposes can without doubt be solved eventually.

Machines have already been constructed, by means of which this valuable product can be mined with facility, and peat has been put to a variety of industrial uses. Progress in Austria in the employment of peat is shown in the manufacture of a patent artificial wood—so-called peat wood. This artificial wood is especially distinguished by the property that, in moist soil, it hardens steadily, owing to the formation of calcareous hydrosilicate of alumina. It is perfectly adapted as a material for street paving, being absolutely free from dust, noiseless, and exceedingly durable. Natural-wood blocks, on the other hand, do not sufficiently resist atmospheric influences, and soon warp. Peat wood is also excellently suited for railroad sleepers. Screws, rivets, and nails become as firmly fastened therein as in the best of oak. Wood sleepers rot in damp soil, while moisture only renders the peat wood harder. All kinds of wood, from willow to oak, can be excellently imitated in this new material, which holds out, in suitable districts, fair promise of growing into a source of profitable business enterprise.—Carl Bailey Hurst, Consul-General at Vienna.

Commercial Museum in Caracas.—Consul-General Guenther, of Frankfort, under date of January 31, 1901, reports:

The Chamber of Commerce of Düsseldorf states that in the near future a commercial museum will be instituted at Caracas to exhibit European industrial and art products; it will receive governmental aid. Branch museums will be opened in Valencia, Maracaibo, Ciudad Bolivar, Barquisimente, and other suitable places. Goods for the museum will be admitted free of duty; this will be exacted only after the goods are sold. No expenses will be charged to the exhibitors. These are advised to send at least five copies of samples and price lists, so that the branches can also be supplied.

Exhibition of Food Articles and Cooking in Belgrade.—Consul-General Guenther reports from Frankfort, February 5, 1901:

German papers publish a telegram from Belgrade, Servia, stating that an international exhibition of food articles and for cooking and hygiene will be held there in April of this year. It will be under the protectorate of the Queen of Servia. A committee has been appointed for the purpose of furnishing information to interested parties. American firms intending to exhibit should at once correspond with our consul at Belgrade in order to secure information without unnecessary delay.

Projected Electric Road in Barcelona.—Consul-General Lay reports from Barcelona, February 12, 1901:

I am informed that Messrs. Corady y Cia. have obtained from the municipality of Barcelona a concession to build an electric railway 8 kilometers (4.9 miles) in length around the mountain of Montjuich. I understand the rails have been contracted for in Belgium. The line is not to be constructed on the trolley system; the cars are to be drawn by electric engines. The chief engineer is the Marquis Armand de Bourbon Neilson, and his address is "care of Messrs. Corady y Cia., Boria, 1 plaza Angel, Barcelona." Our electrical supply and equipment companies should correspond with him. He states that engines, accumulators, and cars are required.

American Machinery in Russia.—Under date of January 22, 1901, Consul Winter, of Annaberg, sends the following translation of an article appearing in the Deutsche Export Zeitung:

"The increase in the trade of the United States with Russia is noticeable. This is due to the cordial relations which exist between these two countries and to the less friendly attitude of Russian merchants toward the manufacturers of other countries. The greater part of the orders for the Siberian Railway has been placed in the United States. Another large order, amounting to $595,000 in value, has just been placed in America for machinery to cut a tunnel of about 1½ miles in length not far from Charbin, in Manchuria. The tunnel is to be finished in one year's time. Direct connections will then be completed between Europe and Vladivostock. The United States has outdistanced Germany in the markets of Russia."

Change of Railway Time in Spain.—Consul-General Lay, of Barcelona, under date of January 18, 1901, transmits copy of a Spanish royal decree fixing the official time on all Spanish railroads, after January 1, 1901, according to Greenwich meridian, instead of that of Madrid, as heretofore. The decree also designates the hours from noon until midnight by the numbers 13 to 24, and all time-tables and railway clocks have been changed accordingly.

Mining Company in Liberia.—Minister Smith writes from Monrovia, January 22, 1901:

The Liberian Legislature has just passed an act granting to the Liberia Union Mining Company the sole right of mining and building railroads, wharves, telegraph and telephone lines, in the counties of Montserrado and Maryland, for a certain period of years. The company has sold its rights to English capitalists, the matter being negotiated through Henry F. Downing, late United States Consul at Loanda, Portuguese West Africa, but now of London.

Non-Inflammable Rubber Tubing.—Consul Hughes, of Coburg, Germany, reports that Müller & Korte, of Pankow, near Berlin, have brought out a new kind of rubber tubing, to be used in cases where damage to the rubber is to be feared either from the flame itself or by contact with hot dishes or stands. The rubber tube is sheathed with asbestos and the asbestos coated with incombustible paint, lest the fibers should peel off. The tubing remains pliable and can be cut as before. Burners with such rubber tubes may be placed on sand baths or hot stoves. The protection is, of course, not absolute; for when the heat becomes too strong the rubber inside will give way. The well-known pipes with metallic spirals were originally made with the same object, but they have found other useful applications, and they differ from these new tubes by being hard and inclined to break; once leaky, they cannot be mended.

A New Alloy in Germany.—Consul Albert writes from Brunswick in regard to magnalium, a new alloy of aluminium and magnesium, with a percentage of from 2 to 30 per cent of the latter metal. Magnalium, it seems, is free from the bad qualities of aluminium, while it retains its light weight, firmness, and tenacity. It is especially applicable in the automobile industry, in electro-technics, aeronautics and dentistry. It can be worked with the file, lathe, and planing machine; it is also admirable as a solder, and its pliability adapts it as a border for lenses and eyeglasses. Magnalium is absolutely weatherproof and does not rust.

Street Cars in St. Petersburg.—Consul-General Holloway transmits the following from St. Petersburg, January 30, 1901:

The municipality of St. Petersburg has already assumed control of three of its present street-car lines and expects to take possession of the remaining lines before the 1st of March, 1901, when the authorities intend to advertise in the leading newspapers of the world for proposals to convert the same to the electrical system. The underground system will be used in the center of the city and the overhead in the suburbs. The present lines are single tracks. The fare is 5 and 6 kopecks (2.57 and 3.09 cents) for inside seats and 1 kopeck (0.5 cent) less for outside, or top, seats.

Cold Storage in Indian Ports.—Deputy Consul Hopley writes from Southampton, January 29, 1901:

A captain of one of the English transports recently told me that the ports of the Indian Ocean were badly equipped with cold-storage plants. Colombo, Ceylon, he instanced as a port of call for all Indian and China transports, and also for a large number of the mail steamers for Australia. The capacity of the plant at that port was 10 tons of meat per week, and it was nothing unusual for one ship to require that much. He stated further that this plant had been equipped with English machinery at a cost of about £15,000 ($72,998), but that the machinery had been tested for the English climate only, and would not work in Ceylon. He expressed surprise that Americans had not investigated the opportunity for cold-storage machinery in Indian Ocean ports.

Demand for American Electric Accessories.—Consul Marshal Halstead, of Birmingham, under date of January 25, 1901, says he has been requested to announce that an English electric-supply company wishes to open up correspondence with American manufacturers of electric accessories. Further information may be had by applying to the consul reporting.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

No. 981. March 11.—United States Cheese in Brazil—*Peat Wood in Austria—Montevideo Port Contract—Coffee Cultivation in Spain—Cultivation of Onions in Egypt—Quinine Auction in Batavia.

No. 982. March 12.—Electricity in India—Railway Development in New Brunswick—Iron and Steel Industries in Canada—Congress against Alcoholism in Vienna—Canadian Preferential Tariff.

No. 983. March 13.—Shoe Industry in Russia—*Sulphur in Russia—The Sicilian Sulphur Combination—Proposed Duties on Cereals in Germany—Russian Duties on United States Imports—Guatemalan Steamship Contract.

No. 984. March 14.—Cinematograph for the Blind in France—German Wine and Grape Trade in 1900—Antwerp Ivory Market—*Commercial Museum in Caracas—Municipal Tramways in Berlin—Lottery Suppressed in Canada.

No. 985. March 15.—Tariff of Venezuela.

No. 986. March 16.—Movement in Austria against American Imports—German Manufactures and Agricultural Products—Meat-Inspection Law in Germany—Swedish and Danish Licenses for Commercial Travelers—Commercial Travelers' Licenses in Brazil—International Art Exhibition at Munich, 1901.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

TRADE NOTES AND RECEIPTS.

Butter Color.—Orlean, 80 grammes; curcuma root (turmeric), 80 grammes; olive oil, 240 grammes; saffron, 1 gramme; alcohol, 5 grammes. The orlean and turmeric are macerated with olive oil and expressed. The weight of the filtered liquid is made up again to 240 grammes with olive oil, next the filtered saffron-alcohol extract is added and the alcohol is expelled again by heating the mixture.—Wiener Drogisten Zeitung.

Belt Glue.—A glue for belts can be prepared as follows, according to the Zeitschrift für Electrotechnik und Maschinenbau: Soak 50 grammes of gelatine in water, pour off the excess of water and heat on the water bath. With good stirring, add, first, 5 grammes of glycerine, then 10 grammes of turpentine and 5 grammes of linseed oil varnish and thin with water as required. The ends of the belts to be glued are cut off obliquely and warmed; then the hot glue is applied, and the united parts are subjected to strong pressure, allowing them to dry thus for 24 hours before the belts are used.

Self-igniting Mantles.—For the production of self-igniting mantles a texture of platinum wire and cotton threads is sewed or woven into the fabric of the mantle. Next, it is impregnated with a solution of thorium salts and dried. The thorium nitrate, on incandescence, gives a very loose but still fire-proof residue. A mixture of thorium nitrate with platinum chloride, after glowing, leaves behind a fireproof sponge, which possesses, in a high degree, the quality of igniting gas mixtures containing oxygen. For 1 part of thorium nitrate 2½ parts of platinum chloride are employed.—Uhland's Technische Rundschau.

Cosmetics.—

LANOLIN TOILET CREME.

Anhydrous lanolin	650
Peach-kernel oil	200
Water	150

Perfume with about 15 drops of Ionon or 20 drops of synthetic Ylang Ylang (Schimmel & Co., Leipsic).

LANOLIN MILK.

Melt anhydrous lanolin	100 grammes.
And add	
Glycerine	100 grammes.
Water	750 grammes.

Put in a wide-necked bottle vessel and add, with continued violent shaking:

Tincture of benzoin	50 grammes.
Mucilage	30 grammes.

and perfume like the crême.

Preparations which have been introduced years ago for the care of the skin and complexion are the glycerine gelées, which have the advantage over lanolin that they go farther, but prevent the drawback of not being so quickly absorbed by the skin. These products are filled either into glasses or into tubes. The latter way is preferable and is more and more adopted owing to the convenience of handling.

A good recipe for such a gelée is the following:

Moisten white tragacanth powder, 50 grammes, with glycerine, 200 grammes, and spirit of wine, 100 grammes, and shake with a suitable amount of perfume; then quickly mix and shake with warmed distilled water, 650 grammes.

A transparent slime will form immediately, which can be drawn off at once.—Drog. Rundschau.

Production of Inflammable Explosive with Chlorate of Potash. By M. Turpin.—M. Turpin employs:

1. As an agent promoting combustion, potassium chlorate.

2. As a combustible agent, an oxidized, nitrated or natural resin.

If, to such a mixture, another body is added in order to render it soft and plastic, such as oil, nitrobenzine, glucose, glycerine, the benefit of the discovery is lost, for the mixture is rendered combustible with nitro-benzine, fecula, sulphur, etc., and inexplosive, with glycerine, glucose, and the oil.

Of all the chlorates and perchlorates, potassium chlorate ($KClO_3$) responds the best to what is desired. As to the resins, they may be varied, or even mixed.

To obtain the oxidation or nitration of the resins, they are heated with nitric acid, more or less concentrated, and with or without the addition of sulphuric acid.

An oxidation, sufficient and without danger, can be secured by a simple and practical means. This is boiling them for several hours in water containing nitric acid, which is renewed from time to time in correspondence with its decomposition. The resins recommended by M. Turpin are of the terebinthine group, having for average formula $C_{20}H_{30}O_2$. Colophony is the type.

The products, thus nitrated, are washed with boiling water, and, on occasion, by a solution slightly alkaline, with a final washing with pure water, and dried at a temperature of 110 deg. C., or in the open air.

The mixing of the constituents of this explosive is preferably cold. For this purpose they are used in the state of fine powder, and when mixed in the tub 2½ to 5 per cent of a volatile dissolvent is added, as alcohol, carbon sulphide, ether, or benzine. As soon as thoroughly mingled, the mass is put either in an ordinary grainer or in a cylinder of wire cloth revolving horizontally on its axis, with glass gobilles forming a screen, by the aid of which the graining is rapidly accomplished. Thus a powder, more or less finely granulated, is produced free from dust.

The proportions preferably employed are:

1.	Potassium chlorate	85 per cent.
	Natural resin	15 per cent.
2.	Potassium chlorate	80 per cent.
	Nitrated resin	20 per cent.

For employment in fire-damp mines, there is added to these compounds from 20 to 40 per cent of one of the following substances: Ammonium oxalate, ammonium carbonate, oxalic acid, sodium bicarbonate, calcium fluoride, or other substance of the nature to lower sufficiently the temperature of the explosive flame.—Translated from La Revue des Produits Chimiques.

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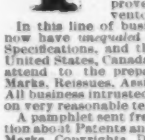

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